# DEVELOPMENT LESSONS.

## For Teachers.

ON

## SIZE, FORM, PLACE, PLANTS, AND INSECTS.

CONTAINING THE INSTRUCTION OF SUPT. FRANCIS W. PARKER, THE ORIGINATOR OF THE "QUINCY SYSTEM" OF TEACHING, AND DEVELOPMENT LESSONS BASED ON THE "OSWEGO SYSTEM" OF TEACHING, AND

## LECTURES ON THE SCIENCE AND THE ART OF TEACHING.

*A GUIDE FOR NORMAL SCHOOLS, INSTITUTE INSTRUCTORS, TEACHERS' INSTITUTES, TEACHERS, AND PARENTS.*

BY

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TO

# Francis W. Parker,

OF ILLINOIS,

as a noble example of the high and honorable position which is attainable by a wise improvement of the study of

THE SCIENCE AND THE ART OF TEACHING,

and with the hope that the great army of teachers in the United States may be stimulated to greater efforts by his worthy example,

THIS VOLUME

is most respectfully dedicated by

THE AUTHORS.

# PREFACE.

TEACHING is regarded as a Science and an Art. As such it may be taught like other sciences and arts, and may be presented in a book, to be studied and applied. This volume is the result of an earnest attempt to present the subjects so that the lessons given may be used by all classes of teachers.

### ORIGIN.

The book is the outgrowth of years of faithful labor in the schoolroom, in teachers' institutes, and in the superintendency of schools. The lessons have been given frequently before teachers and normal training classes, but have not hitherto been collected into a volume.

### CLASSIFICATION OF THE WORK IN EACH LESSON.

The classification of each lesson, — 1. *Object;* 2. *Point;* 3. *Matter;* 4. *Method,*—enables the inexperienced, as well as the experienced, teacher to present the lessons successfully. The author has fully expanded a method of doing the work, and has given explicit directions to assist and govern the teacher.

### OBJECT.

It has not been the aim to give many lessons on the different subjects, but to give *typical* lessons. The work is designed to be used as a text-book on Teaching. It is to be studied, and mastered, by those teaching and those preparing to teach.

In its preparation special effort has been made to classify and de-

velop the different subjects, so that it may be a guide to the acquirement of modern methods of instruction,—a *vade mecum* for normal school teachers and pupils. *The time has passed when talks and lectures alone meet the wants of modern teachers;* and with this view in mind it will prove a valuable aid to students and parents.

More than fifty development lessons are given on the different subjects, and these will enable the teacher to formulate and present other lessons of a similar character.

Teachers are asking, "How can we best prepare ourselves for our work?" We answer, that it is the hope of the author that the present work will aid all who seek after the natural methods.

### "QUINCY WORK."

Special pains have been taken to present and illustrate the work of the Quincy schools. The secret of the success attained in those schools is found in the truism of Comenius: "*Things that have to be done should be learned by doing them.*"

The "Quincy Work," alone, is a compendium on teaching. The author has taken great delight in presenting the work of FRANCIS W. PARKER, the model superintendent of schools, the wise benefactor, and the ablest champion of the rights of children.

### LECTURES ON THE SCIENCE AND THE ART OF TEACHING.

*Nature and Contents.*—A work for teachers should be moulded by the wants of the teachers. The author has endeavored to bear this in mind when formulating the instruction contained in these lectures. Specific instruction has been given on How to teach Reading, Spelling, Phonics, Language, Geography, Arithmetic, etc. The methods to be used, results to be obtained, and cautions to be observed, are definitely set forth. The student teacher should carefully study these, until they become a part of his educational vocabulary.

No attempt has been made to be merely original. The endeavor has been to present the modern methods of teaching.

To FRANCIS W. PARKER, for his kindness in permitting me to use his work and instruction to teachers, I desire to express the hope that this book may be of value to the teachers of our country; that it may aid in building up a better system of education, and inspire all who use it to a greater degree of improvement and professional culture. The author would extend his grateful acknowledgments for encouragement, sincerely hoping that his efforts may contribute to the cause of education.

ESMOND V. DEGRAFF.

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# LESSON ON THE SENSES.

## LESSON I.

**OBJECT.**

To cultivate *Perception*, *Conception*, *Comparison*, *Memory*, and *Language*.

**POINT.**

To develop idea of, and teach the senses, *Seeing*, *Feeling*, *Taste*, *Smell*, and *Hearing*.

**MATTER.**

1. Seeing, Feeling, Taste, Smell, and Hearing are called the *Senses*.
2. We find out (or perceive) through the senses.

**MATERIALS.**

Apples, candy, sugar, salt, vinegar, flowers, etc.

**METHOD.**

*Teacher*. (Having presented objects, and had children talk about them.) John, you may take one of these apples. (Ch. does so.) Which apple did John take?

*Child.* He took the red apple.

*T.* How did you find out that the apple is red?

*Ch.* I found it out by looking at it.

*T.* Tell me that in another way.

*Ch.* I found it out by seeing (or sight).

*T.* What else can you find out about the apple by seeing? (T. write on board word *seeing.*)

*Ch.* I can find out whether it is a large or small apple.

*T.* What else can you find out about the apple by seeing?

*Ch.* I can tell the shape of the apple by seeing.

*T.* What shape is it?

*Ch.* It is round.

*T.* What else can you find out about it by seeing?

*Ch.* I can tell whether it is smooth or rough.

*Ch.* I can tell whether it is shiny or dull.

*T.* When you say the apple is large, of what of the apple are you speaking?

*Ch.* I am speaking of the size of the apple.

*T.* And when you say it is round, of what are you speaking?

*Ch.* I am speaking of the shape of the apple.

*T.* And when you say it is smooth and glossy, of what of the apple are you speaking?

*Ch.* I am speaking of the surface of the apple.

*T.* When you say it is red, of what are you speaking?

*Ch.* I am speaking of the color of the apple.

*T.* Now name all the things you have found out about the apple by seeing.

*Ch.* We have found out the size, shape, color, and kind of surface of the apple by seeing.

*T.* John, you may tell us something more about the apple.

*Ch.* It is a hard apple.

*T.* How do you know it is hard?

*Ch.* I feel it.

*T.* How did John find out that the apple is hard?

*Ch.* He found out that the apple is hard by feeling. (T. write on board word *feeling.*)

*T.* What else can you find out about the apple by feeling?

*Ch.* I can find out whether it is a large or small apple.

*T.* Of what of the apple are you speaking when you say it is large or small?

*Ch.* I am speaking of its size.

*T.* What else can you find out about it by feeling?

*Ch.* I can find out its shape.

*T.* What shape is it? Tell without looking.

*Ch.* It is round.

*T.* Touch something on the table without looking, and tell me its shape.

*Ch.* (Takes a book.) This book is flat.

*T.* What else can you find out about the apple by feeling?

*Ch.* I can find out whether it is rough or smooth.

*T.* Which is it?

*Ch.* It is smooth.

*T.* Now mention all the things you have found out about the apple by feeling.

*Ch.* I have found out by feeling the size, shape, and surface of the apple, and that it is hard.

*T.* How many of these things did you find out by seeing?

*Ch.* We found out the size, shape, and surface of the apple by seeing and by feeling.

*T.* Mention one thing you found out by feeling that you did not by seeing.

*Ch.* We found out that it is hard by feeling, but did not find that out by seeing.

*T.* What did you find out about it by seeing that you did not find out by feeling?

*Ch.* We found out the color and the glossy surface by seeing, but we could not find that out by hearing.

*T.* In what other way can you find out something about this apple?

*Ch.* I could find out something by eating it.

*T.* You may eat a piece of it. (Gives piece to each.) Well, what have you found out?

*Ch.* It is a sour apple.

*T.* How do you know that it is sour?

*Ch.* I can taste it. (Class decision. T. confirm.)

*T.* How did he find out that this apple is sour?

*Ch.* He found it out by tasting. (T. write on board word *tasting.*)

*T.* While tasting it, what else did you observe besides that it is sour?

*Ch.* It is juicy.

*T.* How did you find that out?

*Ch.* I found it out by feeling. (Children may think they perceive juiciness rather by taste than feeling, but if they are led to talk about the nature of juiciness, they will soon perceive the truth.)

*T.* In what other way can you find out something about this apple?

*Ch.* We can smell it.

*T.* You may do so. (Ch. does so.) What have you found out? (Ch. may not be able to explain what he perceives by smelling, in which case the T. will lead him to state that apples have a fragrant odor, which distinguishes them from other fruits.)

*T.* You may tell all that you have learned about this apple.

*Ch.* It is large, round, smooth, glossy, hard, red, sour, and fragrant.

*T.* How did you find out all these things?

*Ch.* We found them out by seeing, feeling, tasting, and smelling.

*T.* Take something from the table, and tell what you find out about it, by seeing. (Children take different things, and describe using only sense of sight. T. have them take a picture and state all they find out about it, by seeing. Then have them describe objects, using only feeling. Have them state what they find out by tasting different things. T. should have present, sugar, salt, spices, and other articles, so as to get the terms *sweet, salt, pung-*

*ent*, *sour*, *bitter*, etc. Have them use terms *hot* and *cold*, as perceived through touch. Have flowers and other articles present that will enable them to distinguish different odors.)

*T.* Name all the means you know by which we find out things.

*Ch.* We find out things by seeing, feeling, tasting, and smelling.

*T.* Who can think of another means by which we found out things?

*Ch.* We find out things by hearing. (Class decision. T. confirm. T. write on board word *hearing*. Have children tell what they can hear.)

*T.* Who can give one name that will apply to all these powers, by which we find out things?

*Ch.* (or *T.*) Seeing, feeling, taste, smell, and hearing, are called *senses*. (Simultaneous recitation. T. write on board full statement.)

*T.* Of what use are the senses to us?

*Ch.* We find out things through the senses. (T. give the term *perceive*, instead of "find out.")

NOTE. — As soon as children perceive the use of the senses, very useful and very interesting lessons may be given upon sensations perceived by each of the senses. As language exercises, the pupils may make statements upon the different sounds they can hear. These statements may be as follows: —

We can hear the dog bark or howl.
We can hear the cat mew.
We can hear the cow low.
We can hear the birds sing.
We can hear the bells ring.
We can hear the wind blow.
We can hear the clock tick.

The teacher will at once perceive the amount of observation in one such lesson, and if the work is done carefully, the children will gain an entirely new understanding of their powers. Have the children state different things they can *see*, *feel*, *taste*, and *smell*, in the same way, and lead them to understand that we *observe* and *perceive* through any and *all* of the senses.

# LESSON ON SIZE.

## LESSON I.

**OBJECT.**

To cultivate *Perception, Conception, Comparison, Judgment, Memory,* and *Language.*

**POINT.**

To develop idea of, and teach *Large, Small, Long, Short, Thick, Thin, Wide, Narrow.*

**MATERIALS.**

Pieces of ribbon, boxes of different sizes, bottles of different sizes, pencils, sticks of candy, strings, pointers, books, etc.

The objects compared must always be of the same kind, but of different sizes.

**METHOD.**

*Teacher.* (Having presented different objects, and had children talk about them.) John, you may find one of the bottles. (Ch. does so.)

*T.* James may find another. (Ch. does so.)

*T.* Which bottle did John find?

*Child.* He found the big bottle. (T. give term *large* for *big.* Write on board word *large.*)

*T.* And which bottle did James find ?

*Ch.* He found the small bottle. (Ch. may say "the little bottle," in which case T. gives term *small.* Write on board word *small.* The teacher will take care that the difference in size is the chief difference between the bottles, and let that be sufficiently great to be readily observed. The teacher will observe that the children know these words, and need only to be taught to apply them correctly.)

*T.* Find a large box.

*Ch.* This is a large box.

*T.* Find a small box.

*Ch.* This is a small box.

*T.* Look round the room and find something that is large and something that is small.

*Ch.* This is a large apple and this is a small apple.

*T.* (Presenting a larger one.) If that is a large apple, what shall we call this?

*Ch.* It is a larger apple. (Class decision. T. confirm.)

*T.* (Producing a still larger apple.) And what shall we call this?

*Ch.* That apple is larger than either of the others; or, that is the largest apple.

*T.* Show me something that is large.

*Ch.* This is a large book.

*T.* Show me a larger book.

*Ch.* This is a larger book.

*Ch.* This is the largest book. (Work similarly for *smaller* and *smallest.*)

*T.* (Presenting two pieces of candy of same thickness but different lengths.) Which of these would you rather have?

*Ch.* I should rather have the long piece. (Write on board word *long.*)

*T.* Why?

*Ch.* Because there is more of it. (Class decision. T. confirm.)

*T.* (Pointing to short piece.) Since you call that the long piece, what shall we call this?

*Ch.* That is the short piece. (Write on board word *short.*)

*T.* (Presenting a piece that is shorter.) And what will you call this?

*Ch.* That is a shorter piece.

*T.* (Presenting a still shorter piece.) What will you call this?

*Ch.* That is the shortest piece.

*T.* Find a long pointer.

*Ch.* This is a long pointer.

*T.* Find a short one.

*Ch.* This is a short one.

*T.* Find something else that is long.

*Ch.* This is a long ribbon.

*T.* Find a longer ribbon.

*Ch.* This is a longer ribbon.

*T.* Find the longest ribbon.

*Ch.* This is the longest ribbon of all. (Have children find objects in the room that are short; have them use *shorter* and *shortest.*)

NOTE.—If child should use *large*, instead of *long*, have him show the way in which it is large, and he will at once be able to use the word *long*. Have children apply *long* and *short* to a variety of objects, *fingers*, *hair*, *lines drawn on the board*, etc.

*T.* (Presenting pieces of ribbon of different widths.) Mary, you may take one of these. (Ch. does so.)

*T.* Which piece did she take?

*Ch.* She took the wide piece. (Write on board word *wide.* Possibly Ch. may say, she took the *large* piece, in which case have her show in which way it is large; and when she shows the direction, tell her that we use the word *wide* to denote size in this direction.)

*T.* Since you call that the wide piece, what will you call this?

*Ch.* That is the narrow piece. (Write on board word *narrow.*)

*T.* (Presenting piece of ribbon wider than the first.) You called that a wide piece; what will you call this?

*Ch.* It is a wider piece.

*T.* (Presenting a still wider piece.) And what will you call this?

*Ch.* That is the widest piece. (Get terms *narrower* and *narrowest* in similar manner.)

*T.* Find something on the table that is wide and something that is narrow. (Children do so, stating what they have done.)

*T.* Look round the room and find something that is wide and something that is narrow. (Children do so, stating fully each time. T. drill on comparative and superlative of wide and narrow, as in previous cases.)

*T.* (Presenting blocks of different thickness, but same shape and size otherwise.) John, which block will you have?

*Ch.* I will take the thick block. (Write on board word *thick.*)

*T.* What will you call this?

*Ch.* That is a thin block. (Write on board word *thin.* Have pupils use comparative and superlative of each. Drill as before, by having children apply terms to different objects in the room. Then lead them to apply several terms to the same object; as, This is a long, narrow, thin ribbon. This is a short, wide, thick ribbon. This is a large, thick box. This is a small, thin box. Drill upon all the words. Have children recall objects they have seen, and apply the terms to them. The work given here under size would probably take one or two weeks, as little children would probably not be able to do more in one lesson than learn to use the words *long* and *short.*)

NOTE. — After the work on Comparative size, Absolute size may be taught. Lead Ch. to appreciate the yard first. Have Ch. state how he can buy a yard of ribbon or cloth at the store. Have him show how

long a yard is. T. show yard-measure. Have Ch. measure a string. This string is a yard long. Apply to other things. Then have Ch. use half yard, then quarter of a yard. Make table:—

2 half yards make 1 yard.
4 quarter yards make 1 yard.
2 quarter yards make ½ yard.

Next teach foot. Lead Ch. to see that 3 feet make 1 yard.
Next teach inch. Lead Ch. to state that 12 inches make 1 foot.

Have pupils apply *inch*, *foot*, and *yard*:—

This table is 4 feet long, and 3 feet wide.
This box is 6 inches long, 4 inches wide, and 2 inches high.

# LESSONS ON FORM.

NOTE 1.—In practical life ability to acquire is preferable to simple possession; so, in intellectual matters, the same preference exists, but in a greater degree.

NOTE 2.—It is best not to give pupils knowledge ready made, but to teach the way to get it.

NOTE 3.—The mere exercise of memory may *arouse* curiosity, but *deadens* intellectual activity.

NOTE 4.—Knowledge is more firmly fixed in the mind by observation than by memorizing alone.

NOTE 5.—Teachers often make the mistake of trying to teach pupils advanced knowledge, and of supposing that immature minds are able to digest and assimilate.

They forget that young pupils have not sufficiently developed ideas for such instruction, and that consequently they ought not to proceed with them from the *general* to the *particular*, but should first establish a foundation of individual observations which can finally be united into a general statement. This may be termed systematic instruction—teaching the *principles* which are the results of generalizing from individual observations.

*Laws* or *Principles* when classified and arranged form a system.

Methodical instruction, or *Method*, is the mode of reaching these principles; or, rather, it is the perfect adaptation of instruction to the mind of the pupil.

This is the *Inductive Method*,—a method that brings together into one general idea a sufficient number of isolated, individual observations to establish a principle,—and a method that should be used before permitting the use of reverse operation; viz.: deduction from the laws obtained from individual cases.

From the above considerations the following method is offered:—

First. *The first thing necessary is Practice in Observing.*

NOTE.—The constant exercise in carefully observing objects of study should of course be progressive, from the easy to the difficult.

Second. *The second thing necessary is the habit and power of describing things observed, accurately.*

NOTE. — Hand in hand with observation goes training in describing the things observed.

Third. *The third thing necessary is to study individual things by themselves; afterwards comes a comparison of these things previously studied separately, so as to bring out their resemblances and differences.*

One single observation accurately made and described is of more value mentally to the pupil than many anecdotes and illustrations.

It is not the teacher, but the pupil who ought to make the description of the things under observation; that is, the thing he has himself observed, not the things with which he has burdened his memory without observation.

Repeating from memory things not observed by the pupils themselves, and mere reciting of school-book information, are the wrong ways of teaching.

Before commencing lessons in *Form*, the pupils should be led to understand the *Senses;* and should have such lessons upon objects as will lead them to appreciate such words as *object*, *length*, *height*, *breadth*, *depth*, and *thickness.* In this connection they may be led to understand the use of the word *dimensions.*

Possibly a course of lessons in *Size* would be the best preparation for the study of *Form.*

Through all the work the teacher must guard against *haste.* In a lesson lasting twenty, or even thirty minutes, a class of young children will seldom learn more than *three* new terms, and any attempt to hurry them must result in their gaining words without the underlying ideas.

They should always be led to appreciate the *necessity* for a new word before it is given them.

In order that children may acquire early habits of correct expression, the teacher must have them pronounce very distinctly, and must *be careful that they make full statements.*

Fragmentary answers or remarks indicate indistinct ideas as well as disconnected thoughts.

As a means of cultivating the judgment, as well as of holding the attention of all the children, frequent class decision is judicious.

The teacher's confirmation of correct judgment should, of course, immediately follow a class decision, as no child should be permitted to remain uncertain whether he is right or wrong.

The teacher must arrange the matter for development as clearly and concisely as possible, and, before meeting her class, must make a definite plan for each lesson; yet she must take care that this plan shall admit

such modifications as circumstances may require. A box of *forms* is, of course, necessary, and in connection with the *forms* the teacher will make use of many familiar objects as means of illustration.

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## LESSON I.

**OBJECT.**

To cultivate *Perception, Conception, Comparison, Memory,* and *Language.*

**POINT.**

To develop idea of, and give terms, *Surface, Faces, Straight* and *Curved Faces, Edge* (*Straight* and *Curved*).

**MATTER.** GENERAL STATEMENTS.

1. *That part of an object which we can see or touch is called the surface.*
2. *The different divisions of a surface are called faces.*
3. *A face whose direction is always the same is called a straight face.*
4. *A face whose direction changes continually is called a curved face.*
5. *The meeting of two faces forms an edge.*
6. *The meeting of two straight faces forms a straight edge.*
7. *The meeting of two curved faces forms a curved edge.*

**METHOD.**

*Teacher.* (Presenting a box to class.) What have I?

*Child.* You have a box.

*T.* (Passing her hand over it, taking care to touch every part.) What am I doing to this box?

*Ch.* You are touching the box.

*T.* How do you know that?

*Ch.* I can see you touching it.

*T.* What senses are you using in order to know that?

*Ch.* I am using the sense of sight.

*T.* You may touch the box. (Ch. does so, T. taking care that she passes her hand over every part.)

*T.* How many senses has John used in examining this box?

*Ch.* He has used two senses, sight and touch. (Class decision. T. confirm.)

*T.* Then what has John done to the box?

*Ch.* John has seen and touched the box.

*T.* You may show me some other part of this box which you can see and touch.

*Ch.* I cannot.

*T.* Why?

*Ch.* I cannot get at it.

*T.* You may show me the part of this ball which you can see and touch. (Ch. does so; other children showing parts of slate, desk, etc., passing their hands carefully over the parts.)

*T.* Who can tell me whether those objects have parts which we cannot see and touch?

*Ch.* They have, but we cannot get at them. (Class decision. T. confirm.)

*T.* Who knows what that part of an object which we can see and touch is called? (Ch. may say the *outside*, but the teacher corrects that by opening a box and showing that they may see or touch the inside of some objects; then she gives the term *surface*, which the class repeat, the teacher taking care that they pronounce the word distinctly.)

*T.* What is a surface?

*Ch.* That part of an object which we can see or touch is called the surface. (Simultaneous recitation. T. write on board.)

*T.* Show me the surface of your slate, desk, ball, etc. (Ch. does so, each time making statement. This is the surface of the slate, This is the surface of the ball, etc. T. drills until she is certain that the term is understood; then the children read the written definition.)

*T.* (Passing her hand over one side of the box.) What am I doing now?

*Ch.* You are touching another part of the box.

*T.* Compare the direction of the part I am now touching with the direction of the part which I first touched, and tell me what you notice.

*Ch.* The direction of the part you are now touching is different from the direction of the part you first touched. (Class decision. T. confirm and explains, saying: We call the different directions of these parts the different inclinations of the surface.)

*T.* How does the inclination here (at the side), or the inclination here (at the end), compare with the inclination here (at the bottom)?

*Ch.* They both differ from that inclination (at the bottom). (Class decision. T. confirm.)

*T.* Show me the different inclinations of the surface of this object (presenting different objects to children, and leading them to make full statements).

*T*. Who can tell what the different inclinations of a surface make? (produce?) (In answer the child will probably give the word *parts*, which the teacher corrects by leading him to see that any place he touches is a part of the whole surface. Then, if the child cannot tell, she gives the term *faces*, and the child makes the full statement: *The different inclinations of a surface* make (produce) *faces*. (Simultaneous recitation. T. write on board.)

*T*. (Presenting objects.) Show me the faces of this object. (Ch. does so, stating: "This is a face," "This is a face," etc.)

*T*. (Presenting box.) Notice carefully, as I pass my hand along this face, and tell me what is true of its change of direction.

*Ch*. It does not change its direction; or, its direction is always the same. (Class decision. T. confirm. T. have children find other faces whose direction is always the same.)

*T*. (Presenting a cup or bottle.) How does the direction of this face compare with the direction of the other?

*Ch*. It is different. (Class decision. T. confirm.)

*T*. How does it differ?

*Ch*. The direction of this face is not always the same.

*T*. Since the direction here is not always the same, what may you say this face does?

*Ch*. It changes its direction. (Class decision. T. confirm.)

*T*. Now look closely, and show me just where this face changes its direction. (Ch. cannot find the place, and at length states that the direction changes *everywhere*, or "all the time," when T. asks for class decision, which she confirms, using the word *continually* instead of the expression "all the time.")

*T*. Who can tell what a face, whose direction is always the same, is called?

*Ch*. A face whose direction is always the same is called (T. or Ch. give term) a straight face. (Simultaneous recitation. T. write on board.)

*T*. Find several faces whose direction changes continually. (Ch. finds several, making full statements about them.)

*T*. What is a face, whose direction changes continually, called?

*Ch*. A face, whose direction changes continually, is called (T. or Ch. give term) a curved face. (Simultaneous recitation. T. write on board.)

*T*. What prevents this face from going farther outward in this direction? (Passing her hand over the top of the box.)

*Ch*. The side face meets it and stops it. (Class decision. T. confirm.)

*T*. And what prevents it going out in this direction? (Passing hand over towards the ends.)

*Ch.* The end face meets it and stops it.

*T.* How many faces meet here?

*Ch.* Two faces meet there.

*T.* Show me other places where two faces meet. (Ch. does so, showing several, and making full statements.)

*T.* Who can tell me what the meeting of two faces makes (forms)?

*Ch.* The meeting of two faces forms (Ch. or T.) an *edge.* (Simultaneous recitation. T. write on board.)

*T.* How many kinds of faces have you learned?

*Ch.* We have learned two kinds of faces, straight faces and curved faces.

*T.* The meeting of two faces forms an edge; now what kind of an edge does the meeting of two straight faces form?

*Ch.* The meeting of two straight faces forms a straight edge, and the meeting of two curved faces forms a curved edge. (Class decision. T. confirm.)

The teacher may drill by having pupils show her *surfaces*, faces (straight and curved), and edges of different kinds, and by having them read the statements written on the board.

Then she may erase statements, and have children recall definitions.

If old enough, the children will write definitions in note-books.

## LESSON II.

NOTE. — Review lesson of yesterday, taking care that the children *understand*, as well as *remember*, *surface*, *straight* and *curved faces*, *straight* and *curved edges*. Then connect the new lesson with the old in such a way that the child will hardly realize where the review ends, and development begins.

### OBJECT.

To cultivate *Perception*, *Conception*, *Comparison*, *Memory*, and *Language*.

### POINT.

To develop idea of, and give terms, *Corner*, *Point*, *Line*, *Straight* and *Curved Lines*.

### MATTER.

1. *The meeting of three edges forms a corner.*
2. *That which has position, but neither length, breadth, nor thickness, is called a point.*
3. *That which has length, but no breadth nor thickness, is called a line.*
4. *A line whose direction is always the same is called a straight line.*
5. *A line whose direction continually changes is called a curved line.*

### METHOD.

*Teacher*. (Presenting box.) Observe this edge (along the side of the box); this one (across the end); and this one (tracing thickness); and tell me what is true of them in regard to each other.

*Child*. They come together.

*T*. Tell me that in another way.

*Ch*. The three edges meet. (Class decision. T. confirm.)

*T*. You may show me three other edges that meet. (Ch. does so; other children finding the same, and making full statements.)

*T*. Who can tell me what the meeting of three edges makes (forms)?

*Ch*. *The meeting* of three edges forms a (Ch. or T. give term) *corner*. (Simultaneous recitation. T. write on board.)

*T*. Find five different corners, and the edges that meet to form each. (Ch. does so, making full statements.)

*T*. Look closely at this corner, and show me exactly where the three edges meet.

*Ch*. I cannot touch the place. (Class decision. T. confirm, showing that it is impossible to touch the place of meeting without touching one of the edges.)

*T*. In connection with the size of objects, how many dimensions have you learned?

*Ch*. We have learned three dimensions, *length*, *breadth*, and *thickness*.

*T*. What dimensions has this place where the three edges meet?

*Ch*. It has no dimensions. (Class decision. T. confirm.)

*T*. It has then no length, breadth, nor thickness; now tell me what it has.

*Ch*. It has place. (Class decision. T. confirm.)

*T*. Who knows another word that means the same as *place?*

*Ch*. or *T*. Position.

*T*. Now tell me all you have learned about this place.

*Ch*. The place where three edges meet has position, but has neither length, breadth, nor thickness.

*T*. Who can tell me what that which has position, but neither length, breadth, nor thickness, is called?

*Ch*. That which has position, but neither length, breadth, nor thickness, is called (Ch. or T.) a *point*. (Simultaneous recitation. T. write on board. T. aids pupil in the construction of this definition, as the expression "that which" is unnatural to a child.)

*T*. John, you may make a point on the board. (John makes a dot.)

*T*. How many think that John has made a point? (Ch. thinks that he has not done so.)

*T*. Why not?

*Ch*. A point has position, but neither length, breadth, nor thickness. That which John made, has *length*, *breadth*, and *thickness*. (Class decision. T. confirm, showing that no dot can be made so small that it does not possess all three dimensions.)

*T*. Now, what may we call that which John has made?

*Ch*. We may call it the picture of a point. (Class decision. T. confirm, also stating that for convenience we shall call it a point.)

*T*. (Presenting box.) Now look at this edge (along the side), and find the exact place where these places meet.

*Ch*. I cannot find the exact place. It seems something like the point. (Class decision. T. confirm.)

*T*. What has this place that the point has not?

*Ch*. It has length.

*T*. How does it resemble the point?

*Ch*. It has no breadth nor thickness. (Class decision. T. confirm.)

*T*. What do we call that which has length, but no breadth nor thickness?

*Ch*. That which has length, but no breadth nor thickness, is called (Ch. or T.) a *line*. (Simultaneous recitation. T. write on board.)

*T*. Mary may make a line on the board.

*Ch.* I cannot make a line.

*T.* Why not?

*Ch.* What I make has breadth and thickness.

*T.* What shall we call that which Mary has made?

*Ch.* We may call it a picture of a line. (Class decision. T. confirm, having children make heavy and light lines, and show breadth and thickness; after which she states that for convenience they will call those pictures *lines.*)

*T.* Out of what do we get a point?

*Ch.* Out of a corner, we get a point.

*T.* Out of what do we get a line?

*Ch.* Out of an edge, we get a line.

*T.* How many classes of edges have you learned?

*Ch.* We have learned two classes of edges, straight and curved edges.

*T.* Then how many classes of lines do you think there are?

*Ch.* There are two classes of lines, straight and curved lines. (Class decision. T. confirm.)

*T.* John may make three straight lines, while Mary may make three curved lines, on the board. (Children do so, other children stating what they have done.)

*T.* What is a straight line?

*Ch.* A line whose direction is always the same is called a *straight* line. (Simultaneous recitation. T. write on board.)

*T.* What is a curved line?

*Ch.* A line whose direction continually changes is called a *curved* line. (Simultaneous recitation. T. write on board.)

REMARK. — Drill by having pupils make pictures of corner, point, line (straight and curved), while others identify each, and others read definitions from the board. Then erase work, remove objects, and have pupils recall what they have learned, and, if able to write, have them write definitions in their books, paying particular attention to penmanship, use of capital letters, punctuation, and spelling. If pupils cannot keep a note-book, have them copy the new terms they have learned on the slate, and make pictures of them.

NOTE. — After teaching straight and curved lines, it will be well to teach crooked or broken lines and compound curves. Here there is nothing new, and the teacher can easily lead the child to see that a broken line is made up of different straight lines, or of straight and curved lines together, while a compound curve is composed of two or more simple curves.

## LESSON III.

Review *Corner*, *Point*, *Line*, (*Straight* and *Curved*).

**OBJECT.**

To cultivate *Perception*, *Conception*, *Comparison*, *Memory*, and *Language*.

**POINT.**

To develop idea of the different kinds of straight lines, and give the terms *Horizontal*, *Vertical*, and *Oblique*.

**MATTER.**

1. *A straight line that extends upward and downward, and inclines neither to the right nor to the left, is called a vertical line.*
2. *A straight line that extends to the right and to the left, and inclines neither upward nor downward, is called a horizontal line.*
3. *A straight line that extends both upward and downward, and inclines both to the right and to the left, is called an oblique line.*

**METHOD.**

*Teacher.* (Presenting ruler with straight edges.) Look at this edge; observe what I am doing, and tell me what is true of its direction (slowly tracing from bottom upward).

*Child.* It goes upward.

*T.* Tell me that, using another word instead of *goes*.

*Ch.* (or *T.*) It extends upward.

*T.* (Tracing edge downward.) Now what is true of its direction?

*Ch.* It extends downward.

*T.* Then in what direction does this edge extend?

*Ch.* It extends both upward and downward. (Class decision. T. confirm.)

*T.* And what is true of its inclination to the right or to the left?

*Ch.* It does not incline to the right nor to the left. (Class decision. T. confirm.)

*T.* Now tell me what you have learned about the direction of this edge.

*Ch.* It extends upward and downward, and does not incline to the right nor to the left. (Class decision. T. confirm.)

*T.* How would you make a picture of this edge?

*Ch.* I should draw a line on the board.

*T.* In order that it should be a true picture of this edge, what must be true of its direction?

*Ch.* It must extend upward and downward, and incline neither to the right nor left.

*T.* You may draw such a line. (Ch. does so; class decision that it is a true picture.)

*T.* Now you may tell me in full what he has done.

*Ch.* He has drawn a straight line which extends upward and downward, and inclines neither to the right nor to the left.

*T.* Who knows the name of a line of which this is true?

*Ch.* A straight line that extends upward and downward, and inclines neither to the right nor to the left, is called a *vertical* line. (If necessary, T. gives term vertical.) (Simultaneous recitation. T. write on board.)

*T.* (Presenting ruler in different position.) In what direction does this edge extend now?

*Ch.* It extends to the right.

*T.* In what other direction does it extend?

*Ch.* It also extends to the left.

*T.* And what is true of its inclination in this direction? (Upward and downward.)

*Ch.* It does not incline upward nor downward. (If children have any difficulty with the words *inclination* and *incline*, the teacher will use the word *bending* or *leaning* until they perceive the meaning of *inclination*.)

*T.* Now tell me what you have learned about the direction of this edge.

*Ch.* It extends to the right and to the left, and inclines neither upward nor downward.

*T.* You may make a picture of this edge. (Ch. draws a horizontal line.)

*T.* What has she done?

*Ch.* She has drawn a line that extends to the right and to the left, and (*a*——*b*) inclines neither upward nor downward. (Class decision. T. confirm.)

*T.* I shall name this line *a*, *b*, and Mary may make three others like it, and name with other letters. (Ch. does so, other children giving full description of each.)

*T.* Now we need the name for this line; who can give it?

*Ch.* A straight line that extends to the right and to the left, and inclines neither upward nor downward, is called (Ch. or T.) a *horizontal* line. (Simultaneous recitation. T. write on board.)

*T.* Mary may draw on the board three vertical lines, and Ann may draw three horizontal lines. (Children do so, other children stating what they have done.)

*T.* (Presenting edge in a different position.) In what direction does this edge extend?

*Ch*. It extends upward and downward.

*T*. And what is true of its inclination to the right or to the left?

*Ch*. It inclines either to the right or to the left.

*T*. Tell me then all that you observe in regard to the direction of this edge.

*Ch*. It inclines to the right or to the left. (Class decision. T. confirm.)

*T*. Mary may make a picture of this edge. (Ch. does so, drawing an oblique line, and, by direction of the teacher, naming it *m*, *n*.)

*T*. Describe the line *m*, *n*, as to direction.

*Ch*. The line *m*, *n*. It inclines either to the right or to the left.

*T*. Who can make the definition from that description, and give the name of such a line?

*Ch*. A straight line that inclines either to the right or to the left is called (Ch. or T.) an *oblique* line. (Simultaneous recitation. T. write on board.)

Drill by having children make different kinds of straight lines and name each, and by having children read and copy definitions from the board. Then erase work, remove objects, and have them recall what they have learned.

Note.—If the children are old enough, it will be well, for the sake of future work in Geometry, to teach the *mathematical* as well as the child's definitions of the different kinds of *straight* lines.

1. *A line pointing to the centre of the earth is called a vertical line.*
2. *A line parallel with the horizon is called a horizontal line.*
3. *A line which is neither vertical nor horizontal is called an oblique line.*

Even with more advanced pupils it will be best to develop first the child's, and afterwards the mathematical, definitions.

As soon as children have learned the different kinds of straight lines, work in designing may be begun. Instead of giving them home tasks to commit to memory, such work as the following may be assigned.

1. Make as many different designs as you can, using two straight lines; three; four; five; etc.

2. Bring me to-morrow three different designs, made by using two vertical and two horizontal lines.

3. Make five different designs, using two horizontal, three vertical, and two oblique lines.

## LESSON IV.

Review carefully *vertical*, *horizontal*, and *oblique* lines.

**OBJECT.**

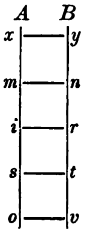
To cultivate *Perception*, *Conception*, *Comparison*, *Memory*, and *Language*.

**POINT.**

To develop idea of, and teach, *Parallel*, *Converging*, and *Diverging* lines.

**MATTER.**

1. *Lines that are the same distance apart throughout their length are called parallel lines.*
2. *Lines that are not the same distance apart throughout their length, but which come together (converge) in one direction, and separate (diverge) in the other direction, are called converging or diverging lines.*




*Teacher.* (Drawing vertical parallel lines on the board.) What have I done?

*Child.* You have drawn two vertical lines, and named them *A* and *B*.

*T.* Now I touch the line *A* at a certain point *x*, and opposite *x* I touch the point *y* in the line *B*. I join these two points by a straight line. What does the line *xy* show?

*Ch.* Line *xy* shows the distance between the lines *A* and *B*. (Class decision. T. confirm.)

*T.* Now I take two points, *m* and *n*, opposite each other, in the lines *A* and *B*. I join these points by a straight line. What does the line *mn* show?

*Ch.* Line *mn* shows distance between the lines *A* and *B*.

*T.* How does the distance between the lines *A* and *B*, shown by line *xy*, compare with the distance shown by *mn?*

*Ch.* The distance between the lines *A* and *B*, shown by line *xy*, is the same as the distance shown by the line *mn*. (Class decision. T. confirm.)

*T.* Now I take two other points *i* and *r*, opposite each other in lines *A* and *B*, and join these points. How does the distance shown by *ir* compare with the distance shown by *xy*, or *mn?*

*Ch.* The distance shown by the line *ir* is the same as that shown by *xy* or *mn*. (Class decision. T. confirm.)

*T.* Compare these distances with the distance shown by *st* or *ov*.

*Ch.* Those distances are the same as those shown by *st* and *ov*. (Class decision. T. confirm.)

*T*. At how many places in the lines *A* and *B* have we found those distances the same?

*Ch*. We have found those distances the same at five places.

*T*. Suppose I join other opposite points in the lines *A* and *B*, how will the distances compare with those we have found?

*Ch*. They will be the same. (Class decision. T. confirm.)

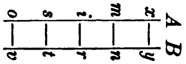
*T*. Through how much of the length of *A* and *B* will they be the same?

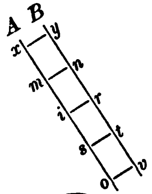
*Ch*. They will be the same through their whole length.

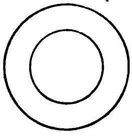
*T*. Thinking of this, then what is true of the lines *A* and *B*?

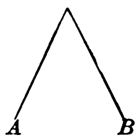
*Ch*. Lines *A* and *B* are the same distance apart throughout their length. (Class decision. T. confirm.)

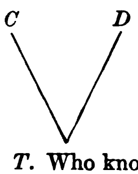
*T*. Who can make other lines that are the same distance apart throughout their length?






*Ch*. I can make horizontal lines that are the same distance apart throughout their length.

*T*. You may do so, and Mary may make lines in some other direction that are the same distance apart throughout their length, while Jane may make others of which this is true. (Children do so, drawing the lines which show the distances, and stating, I have made two *horizontal*, two *oblique*, or two *curved* lines that are the same distance apart throughout their length.)

*T*. Who can tell me what lines of which this is true are called?

*Ch*. Lines that are the same distance apart throughout their length are called (child or teacher) *parallel* lines. (Simultaneous recitation. T. write on board.)

*T*. Look at these lines *A* and *B*, and tell me whether they are *parallel* lines.

*Ch*. They are not parallel lines. They are nearer together at the top than they are at the bottom.

*T*. Tracing the lines *A* and *B* upward, what do they do in regard to each other?

*Ch*. They come together.

*T*. And tracing the lines *C* and *D* downward, what do they do in regard to each other?

*Ch*. They come together toward the bottom.

*T*. Who knows a word that we may use instead of *come together*?

*Ch*. (or *T*.) Converge.

*T*. In how many directions do the lines *A* and *B* converge?

*Ch.* They converge in one direction.

*T.* And in how many directions do the lines *C* and *D* converge?

*Ch.* They converge in one direction.

*T.* Then what kind of lines may we call them?

*Ch.* We may call them *converging* lines. (Class decision. T. confirm.)

*T.* Compare the direction in which I am now tracing the lines *A* and *B* with the direction in which I traced them before.

*Ch.* You are tracing *A* and *B* in the opposite direction from which you traced them before. (Class decision. T. confirm.)

*T.* And what do these lines do now in regard to each other?

*Ch.* They go apart (separate).

*T.* What word may we use which means the same as go apart, and sounds better?

*Ch.* or *T.* *Diverge.*

*T.* Now tell me what is true of the lines *A* and *B*, thinking of the direction in which I am tracing them.

*Ch.* The lines *A* and *B* diverge in the direction opposite to that in which they converge.

*T.* Look at *C* and *D*, and tell me what is true of them in this respect.

*Ch.* Lines *C* and *D* also diverge in the direction opposite to that in which they converge.

*T.* Thinking of this, what kind of lines may we call them?

*Ch.* We may call them diverging lines. (Class decision. T. confirm.)

*T.* Now tell me all you have learned in regard to lines *A* and *B*, and *C* and *D*.

*Ch.* Lines *A* and *B* converge in one direction and diverge in the opposite direction, and lines *C* and *D* converge in one direction and diverge in the opposite direction.

*T.* Thinking of this, what kind of lines may we call them?

*Ch.* We may call them *converging* and *diverging* lines. (Class decision. T. confirm.)

*T.* Who can define *converging* and *diverging* lines?

*Ch.* Lines which are not the same distance apart throughout their length, but which converge in one direction and diverge in the opposite direction, are called *converging* and *diverging* lines. (Simultaneous recitation. T. write on board.)

Drill by having children make different kinds of parallel lines, different converging and diverging lines; by having them describe those already on the board, and by reading and copying in note-books written definitions; after which erase work, close books, and have them recall what they have learned.

Assign, to be brought in next day, a design made up of two parallel lines (or more), and two or three converging and diverging lines. If the

children's ideas of drawing and designing are vague, and if drawing is taught in the school, it would be better for the teacher to assign this work in designing for the *drawing hour*, when she can aid and direct the work, so that it may be done intelligently.

NOTE. — It is hardly necessary to remind the teacher that the correct way of measuring parallel lines is to find the shortest distance between opposite points, and the line joining these points is perpendicular to the parallel lines.

## LESSON V.

Review *Parallel, Converging,* and *Diverging Lines.*

**OBJECT.**

To cultivate *Perception, Conception, Comparison, Memory,* and *Language.*

**POINT.**

To develop idea of, and teach, *Angle, Right Angle, Perpendicular Line, Acute* and *Obtuse Angle.*

**MATTER.**

1. *The opening between two lines, made to look like a knife when it is partly open, is called an angle.*
2. *The opening between two lines, made to look like a knife when it is half way open, is called a right angle.*
3. *A line which meets another line so as to form right angles, is called a perpendicular line.*
4. *The opening between two lines, made to look like a knife when it is less than half way open, is called an acute angle.*
5. *The opening between two lines, made to look like a knife when it is more than half way open, is called an obtuse angle.*

### MATTER FOR MATHEMATICAL DEFINITIONS OF THE SAME.

1. *The divergence between two lines in the same plane is called an angle.*
2. *When a line meets another line so as to form equal angles on the same side of that line, each angle is called a right angle.*
3. *A line which meets another line so as to form right angles, is called a perpendicular line.*
4. *An angle whose divergence is less than that of a right angle, is called an acute angle.*
5. *An angle whose divergence is greater than that of a right angle, is called an obtuse angle.*

NOTE. — The teacher will observe that the child's definitions are developed first, and afterwards the mathematical definitions of the same. It will probably be necessary to divide this lesson into two, if not three, school lessons.

**METHOD.**

*Teacher.* (Presenting a pocket knife closed.) What is this?

*Child.* It is a knife.

*T.* (Opening it.) What have I done?

*Ch.* You have opened the blade.

*T.* Then what may you say of the knife?

*Ch.* It is open.

*T.* Name the parts of this knife.

*Ch.* The parts of that knife are the blade and the handle.

*T.* (Pointing to opening.) What is this?

*Ch.* That is the opening between the blade and the handle.

*T.* How would you make a picture of this knife as you see it now?

*Ch.* I should draw two lines with an opening between them. (Class decision. T. confirm.)

*T.* Mary may do so. (Ch. does so.) What has she done?

*Ch.* She has drawn two lines to look like an open knife.

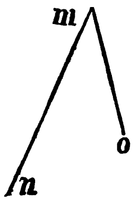
*T.* What do the lines represent?

*Ch.* They represent the blade and the handle.

*T.* (Pointing to opening.) What is this?

*Ch.* That is the opening between the lines.

*T.* The opening between what lines?




*Ch.* The opening between the lines made to look like a knife when it is open.

*T.* Who can make a definition from that description?

*Ch.* The opening between two lines, made to look like a knife when it is open, is called (Ch. or T.) an *angle*. (Simultaneous recitation. T. write on board.)

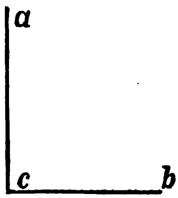
*T.* Who can make other angles?

*Ch.* (Makes several.)

*T.* Show me the angle in each.

*Ch.* The opening between the lines is the angle.

NOTE. — T. may here give terms *vertex* and *sides*, taking care to show that the point where the lines meet is the *vertex*, while the lines themselves are the *sides* of the angle.




*T.* Look at the knife now and tell me how it is.

*Ch.* It is open.

*T.* How far open is it?

*Ch.* It is half way open.

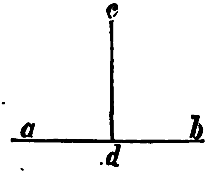
*T.* John may make a picture of it as it is now. (John does so.)

*T.* Describe the opening in that picture.

*Ch.* It is the opening between two lines made to look like a knife when it is half way open.

*T.* Who can make a definition from that description?

*Ch.* The opening between two lines, made to look like a knife when it is half way open, is called (Ch. or T.) a *right* angle. (Simultaneous recitation. T. write on board.)

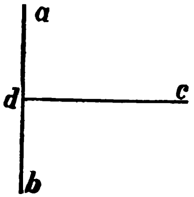


*T.* (Drawing a line.) What have I done?

*Ch.* You have drawn a line, and named it *ab.*

*T.* (Drawing another.) And what have I done now?

*Ch.* You have drawn another line, and named it *cd.*



*T.* Where have I drawn *cd* in regard to *ab*?

*Ch.* You have drawn *cd* to meet *ab* in point *d.*

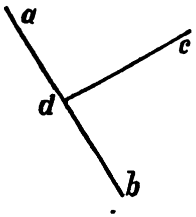
*T.* By drawing these lines in this way, what have I made?

*Ch.* You have made two angles.

*T.* And what kind of angles are they?

*Ch.* They are right angles. (Class decision. T. confirm.)

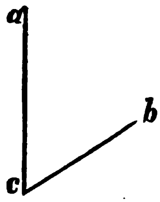
*T.* Who else can draw a line to meet another line so as to form right angles? (Ch. draws several, stating each time, This line meets another line so as to form right angles.)



*T.* Who knows a name for a line which meets another line, so as to form right angles?

*Ch.* A line which meets another line, so as to form right angles, is called (Ch. or T.) a *perpendicular* line. (Simultaneous recitation. T. write on board.)

*T.* Look at this knife again, and tell me what is true of it in regard to the opening.



*Ch.* It is less than half way open. (Class decision. T. confirm.)

*T.* Who can make a picture of it? (Ch. does so, stating, This is the opening between two lines made to look like a knife less than half way open.)

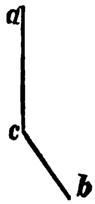
*T.* Who can make a definition to fit that description?

*Ch.* The opening between two lines, made to look like a knife when it is less than half way open, is called an *acute* angle. (Simultaneous recitation. T. write on board.)

*T.* Look at the knife now, and tell me what is true of it.

*Ch.* It is more than half way open.

*T.* Make a picture of it, and speak of the opening.

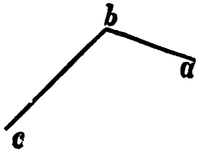



*Ch.* This is the opening between two lines made to look like a knife when it is more than half way open.

*T.* John may make the definition.

*Ch.* The opening between two lines, made to look like a knife when it is more than half way open, is called (Ch. or T.) an *obtuse* angle. (Simultaneous recitation. T. write on board.) Drill as usual, then proceed to develop the mathematical definitions of *angle, right-angle, perpendicular* line, *acute* and *obtuse* angles.)

*T.* (Referring to first angle on the board.) Compare the direction of these lines *nm* and *om*, and tell me what is true of them.




*Ch.* They have different directions. (Class decision. T. confirm.)

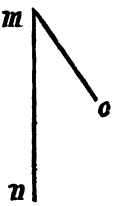
*T.* What shows that they have different directions?

*Ch.* The opening shows it.

*T.* Then what is this opening between the lines?

*Ch.* It is the difference of direction between the lines. (Class decision. T. confirm.)

*T.* Who knows one word that we may use instead of "difference of direction"? (Ch. does not know. T. gives term *divergence.*)




*T.* Now what is this opening?

*Ch.* It is the divergence between two lines.

*T.* Observe the surface of this board, and tell what kind of surface it is.

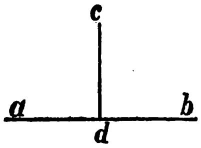
*Ch.* It is a *smooth* surface, or *level* surface, (if Ch. gives smooth, flat, or level surface, the T. may give instead the word *plane*) or *plane* surface.

*T.* Then compare the position of these two lines, *nm* and *om*, in regard to the plane.

*Ch.* They are in the same plane. (Class decision. T. confirm.)

*T.* Thinking of this, speak of the divergence.

*Ch.* It is the divergence between two lines in the same plane. (Class decision. T. confirm.)




*T.* Who can make a definition from that description?

*Ch.* The divergence between two lines in the same plane is called an *angle.* (Simultaneous recitation. T. write on board.)

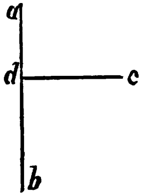
*T.* (Again referring to previous work in right angles.) How is *cd* drawn in regard to *ab*?

*Ch.* *cd* is drawn to meet *ab.*

*T.* And what has been formed?

*Ch.* Two angles have been formed.

*T.* Where are those angles in regard to the line *ab*?




*Ch.* They are on the same side of the line *ab.* (Class decision. T. confirm.)

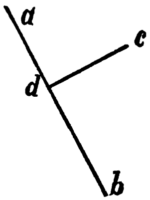
*T.* How do those angles compare in size?

*Ch.* They are equal. (Class decision. T. confirm.)

*T.* Now state carefully what is true of *cd.*

*Ch.* Line *cd* meets the line *ab,* so as to form equal angles on the same side of line *ab.* (Class decision. T. confirm.)

*T.* Now who can make the definition of these angles?

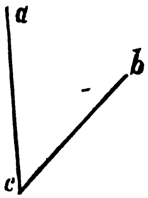



*Ch.* When a line meets another line so as to form equal angles on the same side of that line, each of the angles is called a *right* angle. (Simultaneous recitation. T. write on board.)

*T.* Who can give me the name of a line which meets another line so as to form right angles?

*Ch.* A line which meets another line so as to form right angles is called a (Ch. or T.) *perpendicular* line. (Simultaneous recitation. T. write on board.)

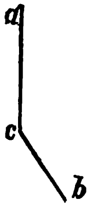
*T.* (referring to acute angle.) How does the divergence of this angle compare with that of the right angle?




*Ch.* The divergence of that angle is less than that of a right angle. (Class decision. T. confirm.)

*T.* Thinking of this, who can make a definition?

*Ch.* An angle whose divergence is less than that of a right angle is called an *acute* angle. (Simultaneous recitation. T. write on board.)




*T.* (Referring to obtuse angle.) How does the divergence of this angle compare with that of a right angle?

*Ch.* The divergence of that angle is greater than that of a right angle. (Class decision. T. confirm.)

*T.* Who can make the definition?

*Ch.* An angle whose divergence is greater than that of a right angle is called an *obtuse* angle. (Simultaneous recitation. T. write on board.)

Drill by having children make different angles and describe, and by reading and copying written definitions. Then erase work, remove objects, close books, and have them recall what they have learned.

As an exercise in designing, ask children to make a design containing right angles only; one containing two acute, two obtuse, and two right angles. The combinations that may be made with angles are endless. Two or three weeks of profitable work in drawing may be devoted to the study of angles, while little problems such as the following may be given. Find the number of angles that can be made with two, three, four, five, or six lines.

## LESSON VI.

Review *Angle, Right, Acute,* and *Obtuse, Angle,* and *Perpendicular Line.* If the teacher has not in the last lesson taught *adjacent* angles, they can be taught at the beginning of the present lesson.

**OBJECT.**

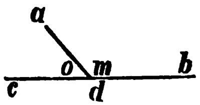
To cultivate *Perception, Conception, Comparison, Memory,* and *Language.*

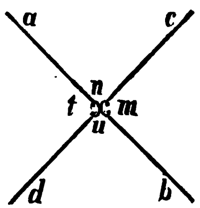
**POINT.**

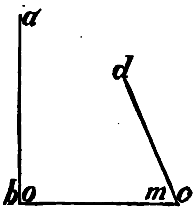
To develop idea of, and teach, *Adjacent, Vertical, Alternate,* and *Opposite* angles.

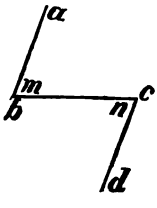
**MATTER.**

1. *Angles which have one common vertex, and one common side, are called adjacent angles.*
2. *When one line intersects another line, the angles which are not adjacent are called vertical angles.*
3. *If, on the same side, a line is drawn to each extremity of a given line, the angles thus formed are called opposite angles.*
4. *If, on opposite sides, a line be drawn to each extremity of a given line, the angles thus formed are called alternate angles.*




**METHOD.**

*T.* (Drawing a line on board.) What have I done?

*Ch.* You have drawn a line *bc*.

*T.* (Again drawing a line.) And now what have I done?

*Ch.* You have drawn a line *ad* to meet *bc* in the point *d*.

*T.* And what have I formed?

*Ch.* You have formed two angles *o* and *m*.

*T.* What is the vertex of angle *o*?

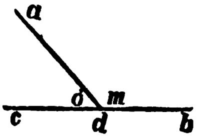
*Ch.* *d* is the vertex of angle *o*.

*T.* And what is the vertex of angle *m*?

*Ch.* *d* is the vertex of angle *m*.

*T.* Then what is true of the angles *o* and *m*?

*Ch.* They have the same vertex.




*T.* Who can tell me that in another way?

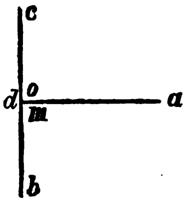
*Ch.* (or *T.*) They have one common vertex.

*T.* Look carefully and tell me whether you see anything else that angles *o* and *m* have in common.

*Ch.* Angles *o* and *m* have one common side *ad.* (Class decision. T. confirm.)

*T.* What have you learned about angles *o* and *m*?

*Ch.* They have one common vertex, and one common side.



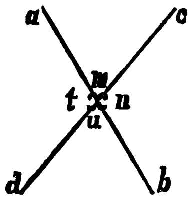

*T.* Who can make other angles that have one common vertex and one common side? (Children make several, each stating what he has done.)

*T.* Who knows what we need now?

*Ch.* We need a definition. (Class decision. T. confirm.)

*T.* You may make it.

*Ch.* Angles which have one common vertex, and one common side, are called (T. give term) *adjacent* angles. (Simultaneous recitation. T. write on board.)




*T.* (Drawing line.) What have I done?

*Ch.* You have drawn a line *ab.*

*T.* (Again drawing a line.) And what have I done now?

*Ch.* You have drawn a line *cd.*

*T.* Where is *cd* in regard to *ab*?

*Ch.* *cd* crosses *ab.*

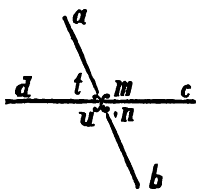
*T.* You may use the word *intersects,* instead of *crosses.* (Explains meaning of *intersects.*)

*Ch.* Line *cd* intersects the line *ab.*

*T.* What have I formed?

*Ch.* You have formed four angles, *m, n, u, t.*

*T.* Thinking of what you have just learned, what kind of angles are *m* and *n*?



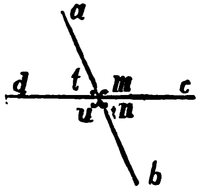

*Ch.* *m* and *n* are adjacent angles. (Class decision. T. confirm.)

*T.* Find other adjacent angles.

*Ch.* *n* and *u* are adjacent angles, *u* and *t* are adjacent angles, and *t* and *m* are adjacent angles. (Class decision. T. confirm.)

*T.* Find angles which are not adjacent.

*Ch.* *m* and *u* are not adjacent, and *n* and *t* are not adjacent angles.




*T.* How have those angles been formed?

*Ch.* They have been formed by one line intersecting another line.

*T.* Now who can make a definition?

*Ch.* When one line intersects another line, the angles which are not adjacent are called (T. give term) *vertical* angles. (Simultaneous recitation. T. write on board.)

*T.* (Drawing a line.) What have I done?

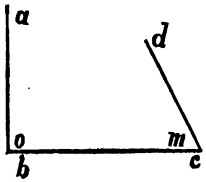
*Ch.* You have drawn a line *bc*.

*T.* And now what have I done?

*Ch.* You have drawn a line *ab* to meet *bc* in point *b*.

*T.* Where in regard to *bc* have I drawn *ab*?

*Ch.* You have drawn *ab* to one end of *bc*.




*T.* You may use some other word that will mean the same as *end*.

*Ch.* (or *T.*) *Extremity.*

*Ch.* You have drawn *ab* to one extremity of *bc*.

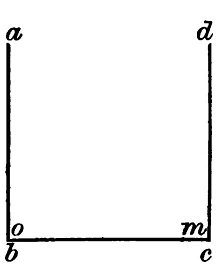
*T.* (Drawing line *dc*.) And what have I done now?

*Ch.* You have drawn line *dc* to the other extremity of *bc*.

*T.* How many lines have I drawn to the extremities of *bc*?

*Ch.* You have drawn one line to each extremity of *bc*. (Class decision. T. confirm.)

*T.* Compare the position of those two lines *ab* and *dc* in regard to *bc*.




*Ch.* *ab* and *dc* are on the same side of *bc*. (Class decision. T. confirm.)

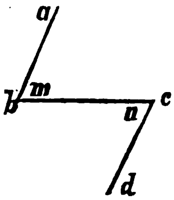
*T.* By drawing these lines in this way, what have I formed?

*Ch.* You have formed two angles, *o* and *m*.

*T.* Describe fully how these angles have been formed.

*Ch.* By drawing on the same side a line to each extremity of a given line, you have formed angles *o* and *m*.

*T.* You may make other angles in the same way. (Ch. does so, stating fully what he has done.)




*T.* If, on the same side, a line be drawn to each extremity of a given line, what are the angles thus formed called?

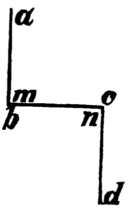
*Ch.* If, on the same side, a line be drawn to each extremity of a given line, the angles thus formed are called *opposite* angles. (Simultaneous recitation. T. write on board.)

*T.* (Drawing a line.) What have I done?

*Ch.* You have drawn a line, *bc*.

*T.* (Drawing *ab*.) And what have I done now?

*Ch.* You have drawn line *ab* to one extremity of *bc*.




*T.* (Drawing *dc*.) And what have I done now?

*Ch.* You have drawn line *dc* to the other extremity of *bc*.

*T.* How many lines have I drawn to the extremities of *bc*?

*Ch.* You have drawn one line to each extremity of *bc*.

*T.* Compare the position of *ab* and *dc* in regard to *bc*.

*Ch.* *ab* and *dc* are on *opposite* sides of *bc*. (Ch. may say they are not on the same side of *bc*, when T. will lead him to say on *opposite sides*. Class decision. T. confirm.)

*T.* By drawing these lines in this way, what have I formed?

*Ch.* You have formed two angles, *m* and *n*.

*T.* Describe fully how these angles have been formed.

*Ch.* By drawing, on opposite sides, a line to each extremity of a given line, you have formed two angles *m* and *n*. (Class decision. T. confirm.)

*T.* Who can make the definition from that description?

*Ch.* or *T.* If, from opposite sides, a line be drawn to each extremity of a given line, the angles thus formed are called (T. give term) *alternate* angles. (Simultaneous recitation. T. write on board.)

Drill by having children make different angles and describe fully; by T. making them and having children identify; by having them read and copy definitions in note-books. Then erase work, close books, and have them recall what they have learned.

Assign, as home work, designs in which a *limited* number of specified angles are to be used. It is needless to suggest that particular care should be given to neatness and correctness of werk in designing. The best designs should be preserved in *portfolios*, where the whole class can upon occasion examine them. The papers used should be all of the

same size, and at first should be about eight inches long by ten wide. Pencils should be attended to. If the children are small, an hour *in school* had better be given to this work in order that the teacher may direct it.

As a preparation for Geometry, the child may now be led to the conclusions that, if one of two adjacent angles is a *right* angle, the other must be a *right* angle also; or, if one be acute, the other must be obtuse; or, if one be obtuse, the other must be acute; and that:

1. *The value of the sum of two adjacent angles equals two right angles.*

2. *The value of the sum of all the angles having a common vertex, on the same side of a given line, equals two right angles.*

3. *The value of all the angles round a given point (having a common vertex) equals four right angles.*

Also, the child may be led to see that vertical angles are equal; that the value of the sum of two opposite angles between parallel lines equals two right angles; that alternate angles between parallel lines are equal.

It is possible that some teachers may be startled at the idea of little children solving problems in geometry; but, in fact, they are only learning to use their eyes, and to state what they cannot help seeing if they *do* use them. The child does not know that he is studying geometry; he only knows that he is each day making delightful discoveries in regard to common things.

## LESSON VII.

Review all of previous work in Form, taking care to have children *understand* and *remember* what has been developed. *Take as much time as may be necessary, and do not hurry the children.*

### TRIANGLES.

**OBJECT.**

To cultivate *Perception, Conception, Comparison, Reason, Memory,* and *Language.*

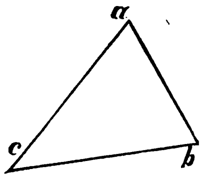
**POINT.**

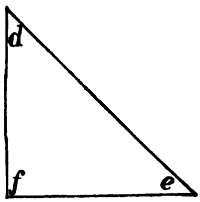
To develop idea of, and teach, *Triangle, Right-angled, Acute-angled,* and *Obtuse-angled Triangles.*

**MATTER.**

1. *A space enclosed by three sides is called a triangle.*
2. *A triangle having one right angle and two acute angles is called a right-angled triangle.*
3. *A triangle having one obtuse angle and two acute angles is called an obtuse-angled triangle.*
4. *A triangle which has all its angles acute is called an acute-angled triangle.*

**METHOD.**




*T.* (Arranging three rulers to form a triangle.) When you were little boys and girls, you all liked to play with sticks, and you often placed them as I am doing now. What were you playing then?

*Ch.* We were playing at building houses. (Class decision. T. confirm.)

*T.* What are the parts of this house?

*Ch.* The walls and the room inside are the parts of that house.

*T.* What are the walls?

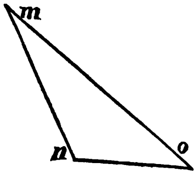
*Ch.* The sticks are the walls, and the place shut in by the sticks is the room.

*T.* Who can use one word that will mean the same as "shut in"?

*Ch.* (or *T.*) *Enclosed.*

*T.* Who can use a word that will mean the same as "room"?

*Ch.* (or *T.*) *Space.*




*Ch.* The space enclosed by the sticks is the room. (Class decision. T. confirm.)

*T.* By how many sticks is this space enclosed?

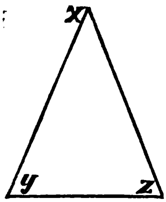
*Ch.* It is enclosed by three sticks.

*T.* How can you make a picture of this space?

*Ch.* I can enclose a space by three lines on the board.

*T.* You may do so, and in describing what you have done, use another word instead of *lines.*

*Ch.* This is a space enclosed by three sides. (Other children make several, each stating what he has done.)




*T.* Who can tell what such a space is called?

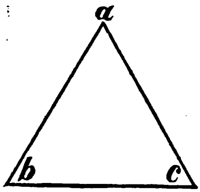
*Ch.* A space enclosed by three sides is called (T. give term) a *triangle.* (Simultaneous recitation. T. write on board. Explain meaning of the word *triangle.*)

*T.* By enclosing a space by three sides, what have you formed?

*Ch.* I have formed angles. (Class decision. T. confirm.)

*T.* How many angles has a triangle?

*Ch.* A triangle has three angles. (Class decision. T. confirm.)




*T.* (Making a right-angled triangle.) What have I done?

*Ch.* You have made a triangle.

*T.* Look carefully at it, and compare it with the first one you made.

*Ch.* It is different from the one I made.

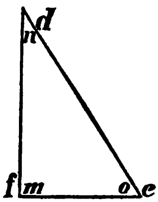
*T.* How does it differ?

*Ch.* It has a right angle.

*T.* How many right angles has it?

*Ch.* It has one right angle; the angle *m.*

*T.* What kind of angles are the other two?

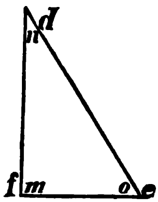



*Ch.* They are acute angles. (Class decision. T. confirm.)

*T.* Thinking of what you have observed, describe this triangle fully.

*Ch.* That triangle has one right angle and two acute angles.

*T.* Who can make other triangles of which this is true?




(Children make several, each stating what he has done.)

*T.* What do we need now?

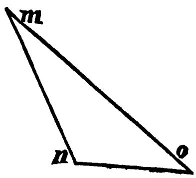
*Ch.* We need the definition and the name of that triangle. (Class decision. T. confirm.)

*T.* Who can make it?

*Ch.* A triangle having one right angle and two acute angles is called (T. give term) a *right-angled* triangle.

*T.* (Making an obtuse-angled triangle.) What have I done now?

*Ch.* You have made a triangle which has one obtuse angle. (Class decision. T. confirm.)




*T.* What kind of angles are the other two?

*Ch.* They are acute angles.

*T.* Describe this triangle.

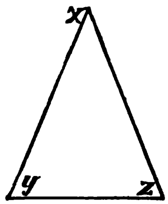
*Ch.* That triangle has one obtuse angle and two acute angles.

*T.* Who can make the definition?

*Ch.* A triangle having one obtuse angle and two acute angles is called an *obtuse-angled* triangle. (Simultaneous recitation. T. write on board.)

*T.* (Making an acute-angled triangle.) What is true of the angles of this triangle?

*Ch.* All of the angles of that triangle are acute. (Class decision. T. confirm.)




*T.* Make other triangles of which this is true. (Children make several, each stating what he has done.)

*T.* Who can make the definition to suit that description?

*Ch.* A triangle which has all its angles acute is called an *acute-angled* triangle. (Simultaneous recitation. T. write on board.)

Drill by having children make different triangles, and by having others identify; by showing forms and having them describe; and by having them read and copy definitions on the board. Then erase work, close books, remove objects, and have them recall what they have learned.

NOTE.—The teacher may, by this time, be able to lead children to state that the *description* must always precede the *definition*, as the latter

depends entirely upon the former, thus establishing in them a habit of careful investigation before deducing principles.

### As Work in Inventive Drawing.

1. Bring in a design composed of the three different triangles you have learned. (May repeat either of the elements, if necessary, but have only these three elements.)
2. Decorate a *right-angled* triangle with obtuse angles.
3. Make a design composed entirely of obtuse-angled triangles, and decorate with right angles.

Note.—It will be well now to lead the children to the idea that each design is for some purpose. It may be for a figure in wall-paper. It may be for a border in *frescoing* or *stencilling*. It may be for a figure for a carpet or a mat, or for oil-cloth, or for iron fence, etc. The teacher should procure pieces of calico, paper, carpets, etc., in which the designs can be examined, and lead the children to study the elements employed.

## LESSON VIII.

Review *Triangle*, *Right-angled*, *Obtuse-angled*, and *Acute-angled Triangles*

**OBJECT.**

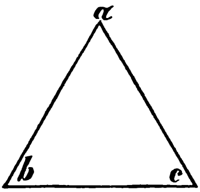
To cultivate *Perception*, *Conception*, *Comparison*, *Memory*, and *Language*.

**POINT.**

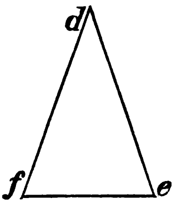
To develop idea of, and teach, *Equilateral*, *Isosceles*, and *Scalene Triangles; Base*, *Vertex*, and *Altitude* of a triangle.

**MATTER.**

1. *A triangle having all its sides equal is called an equilateral triangle.*

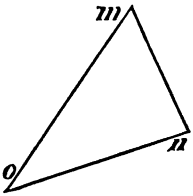



2. *A triangle having two of its sides equal is called an isosceles triangle.*
3. *A triangle having three unequal sides is called a scalene triangle.*
4. *The side upon which the triangle rests (stands) is called the base of a triangle.*
5. *The vertex of the angle opposite the base is called the vertex of a triangle.*
6. *The perpendicular distance from the vertex to the base (or to the base produced) is called the altitude of a triangle.*

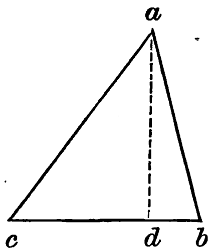



**METHOD.**

*Teacher.* (Presenting form.) What is this?
*Child.* It is a triangle.
*T.* Compare the sides with each other.
*Ch.* Its sides are equal.
*T.* How many of its sides are equal?
*Ch.* All its sides are equal. (Class decision. T. confirm.)




*T.* Find other triangles of which this is true, and make pictures of them on the board. (Children make several, and find several among the forms, each stating, "This is a triangle having all its sides equal.")
*T.* Who can make the definition from that description?



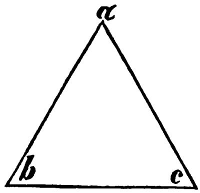

*Ch.* A triangle having all its sides equal is called (T. give term) an *equilateral* triangle. (Simultaneous recitation. T. write on board.)

*T.* Now look at this triangle, and tell me what is true of its sides, in regard to each other.

*Ch.* That triangle has two of its sides equal. (Class decision. T. confirm.)

*T.* Find others of which this is true, make pictures of them, and make the definition.

*Ch.* A triangle having two of its sides equal is called (T. give term) an *isosceles* triangle. (Simultaneous recitation. T. write on board.)

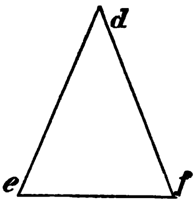



NOTE.—The teacher will understand that, while some of the pupils are seeking among the *forms*, others may make the pictures on the board, while still others may make the description and the definition. This keeps the whole class busy.

*T.* Look at this triangle, and tell me how many of its sides are equal.

*Ch.* That triangle has no equal sides. (Class decision. T. confirm.)

*T.* Since that is so, what kind of sides may we call them?



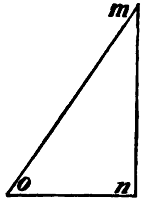

*Ch.* They are unequal sides. (Class decision. T. confirm.)

*T.* Now describe this triangle.

*Ch.* That is a triangle having three unequal sides.

*T.* Find others of the same kind, make pictures of them, and make the definition.

*Ch.* A triangle having three unequal sides is called (T. give term) a *scalene* triangle. (Simultaneous recitation. T. write on board.)



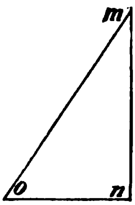

*T.* Look at these triangles that have been made on the board, $\triangle abc$, $\triangle def$, and $\triangle mon$. What is the side *bc* to the triangle *abc*?

*Ch.* It is the side upon which the triangle *abc* stands (or rests). (Class decision. T. confirm.)

*T.* Name the side upon which triangle *dfe* rests.

*Ch.* *fe* is the side upon which triangle *dfe* rests.

*T.* And what is the side upon which triangle *mon* rests?




*Ch.* *on* is the side upon which triangle *mon* rests.

*T.* If we could move these triangles, tell me whether we could make them rest on any other sides?

*Ch.* They could rest on either of the other sides. (Class decision. T. confirm, illustrating by means of forms.)

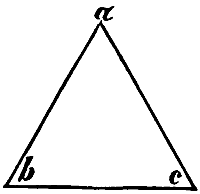
*T.* Who knows what the side upon which the triangle rests is called?

*Ch.* The side upon which the triangle rests is called (T. give term) the *base* of a triangle. (Simultaneous recitation. T. write on board.)

*T.* Look at this triangle *abc*, and tell me to what I am pointing.

*Ch.* You are pointing to an angle of the triangle *abc*.

*T.* Where is this angle, in regard to the base *bc*?




*Ch.* It is just opposite the base. (Class decision. T. confirm.)

*T.* To what part of the angle am I pointing?

*Ch.* You are pointing to the vertex of the angle.

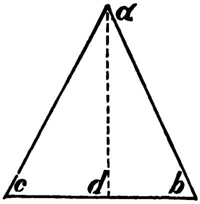
*T.* I am pointing to the vertex of what angle?

*Ch.* You are pointing to the vertex of the angle opposite the base *bc*.

*T.* Find the vertex of the angle opposite the base in each of the other triangles. (Children do so, stating fully what they have found.)

*T.* Who can tell what of the triangle the vertex of the angle opposite the base is called?

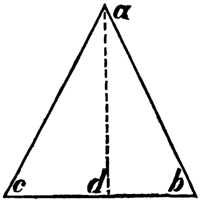
*Ch.* The vertex of the angle opposite the base is called (T. give term) the *vertex of the triangle.* (Simultaneous recitation. T. write on board.)




NOTE. — Teacher may here explain that the *angle* opposite the base of the triangle is called the *vertical* angle.

*T.* (Making triangle and dropping perpendicular line.) What have I done?

*Ch.* You have made a triangle *abc*, and have drawn a line *ad* inside of it.




*T.* From where to where have I drawn this line *ad*?

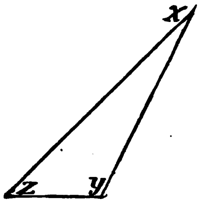
*Ch.* You have drawn the line *ad* from the vertex to the base of the triangle. (Class decision. T. confirm.)

*T.* By drawing this line *ad*, what have I formed with the base?

*Ch.* You have formed angles with the base.

*T.* What kind of angles are they?

*Ch.* They are right angles. (Class decision. T. confirm.)



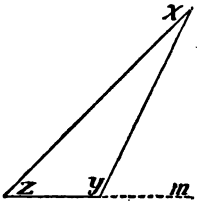

*T.* Since they are right angles, what kind of a line is *ad*?

*Ch.* Line *ad* is a perpendicular line.

*T.* And what does line *ad* show?

*Ch.* Line *ad* shows the distance between the vertex and the base of the triangle. (Class decision. T. confirm.)

*T.* Since *ad* is a perpendicular line, what kind of distance does it show?



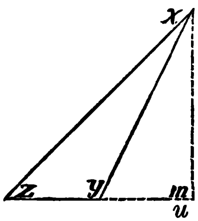

*Ch.* *ad* shows the perpendicular distance between the vertex and the base of the triangle. (Class decision. T. confirm.)

*T.* Show the perpendicular distance between the vertex and the base in each of these other triangles. (Children do so, each stating what he has done.)

*T.* (Making triangle *xyz.*) What have I done?

*Ch.* You have made a triangle *xyz.*

*T.* (Producing *xy* to *m.*) What have I done now?




*Ch.* You have produced the base to *m.*

*T.* Then what may you call *ym*?

*Ch.* *ym* is the base produced. (Class decision. T. confirm.)

*T.* (Dropping perpendicular *xu.*) What have I done now?

*Ch.* You have drawn a perpendicular line *xu.* (Class decision. T. confirm.)

*T.* From where to where have I drawn *xu*?

*Ch.* You have drawn it from the vertex of the triangle to the base produced.

*T.* What does the perpendicular line from the vertex to the base produced show?

*Ch.* It shows the perpendicular distance as before. (Class decision. T. confirm.)

*T.* Who can make the definition and give the name for the perpendicular distance from the vertex to the base, or to the base produced, of a triangle?

*Ch.* The perpendicular distance from the vertex to the base, or to the base produced, of a triangle, is called the *altitude* of the triangle. (Simultaneous recitation. T. write on board.)

Drill by having children find or make the different triangles, and name and describe; by having them read and copy definitions; by having them find *base, vertex,* and *altitude* of different triangles. Then erase work, remove objects, close books, and have them recall what they have learned.

### As Work in Inventive Drawing.

1. Make a design for an iron gate composed of *equilateral* triangles.
2. Make a design for the border of a rug, composed of *isosceles* triangles, decorated with curves.
3. Make a design for the centre of a table cover composed of the three different kinds of triangles, repeating each element as often as necessary.

Note. — Teacher will of course study such designs as he sees around him, and lead the children to see in what directions the elements are to be repeated in different designs; thus: In a design for a border, repeat the elements in a horizontal direction; for curtains or for a wall, repeat the element of the design vertically; for a centre-piece of a square, repeat the element in every direction from a common centre.

## LESSON IX.

Review *Equilateral*, *Isosceles*, and *Scalene Triangles*; *Base*, *Vertex*, and *Altitude* of a Triangle.

### Figures Having Four Sides.

**OBJECT.**

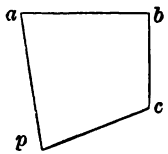
To cultivate *Perception*, *Conception*, *Comparison*, *Reason*, *Memory*, and *Language*.

**POINT.**

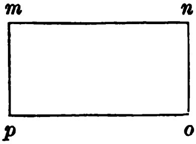
To develop idea of, and teach, *Quadrilateral*, *Parallelogram*, *Square*, *Rhomb*.

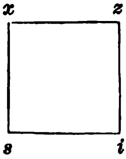
**MATTER.**

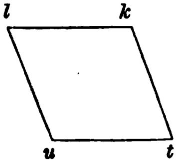
1. *A space enclosed by four sides is called a quadrilateral.*




2. *A quadrilateral having its opposite sides parallel is called a parallelogram.*
3. *A parallelogram having all its sides equal, and all its angles right angles, is called a square.*
4. *A parallelogram having all its sides equal, and having one pair of its opposite angles obtuse, and the other pair acute, is called a rhomb.*




**METHOD.**

*Teacher*. (Drawing quadrilateral.) What have I done?

*Child*. You have drawn four lines.

*T.* By drawing these four lines in this way, what have I done?

*Ch.* You have enclosed a space.

*T.* What of the space may you call those lines?

*Ch.* Those lines are the sides of the space.

*T.* Describe this space.

*Ch.* That is a space enclosed by four sides.

*T.* Look around the room and find spaces enclosed by four sides. (Ch. finds several, stating each time, "This is a space enclosed by four sides.")

*T.* Who can make a definition to suit that description?

*Ch.* A space enclosed by four sides is called (T. give term and explain) a *quadrilateral*. (Simultaneous recitation. T. write on board.)

*T.* (Presenting form.) What is this?

*Ch.* That is a quadrilateral because it has four sides. (Class decision. T. confirm.)

*T.* (Touching one side.) What am I doing?

*Ch.* You are touching one side of the quadrilateral.

*T.* (Touching other side.) What am I doing now?

*Ch.* You are touching another side of the quadrilateral.

*T.* Where are those sides in regard to each other?

*Ch.* They are opposite each other. (Class decision. T. confirm.)

*T.* Thinking of their distance apart throughout their length, what kind of sides are they?

*Ch.* They are parallel. (Class decision. T. confirm.)

*T.* (Touching other sides.) What am I doing now?

*Ch.* You are touching the other two sides.

*T.* Where are they in regard to each other?

*Ch.* They are opposite.

*T.* And thinking of their distance apart, what is true of them?

*Ch.* They are parallel.

*T.* Then what is true of the opposite sides of this quadrilateral?

*Ch.* The opposite sides of that quadrilateral are parallel. (Class decision. T. confirm.)

*T.* Find other quadrilaterals of which this is true. (Ch. finds several, making a full statement each time.)

*T.* Make on the board a quadrilateral having its opposite sides parallel. (Ch. does so, making a description.)

*T.* Who can make a definition to suit that description?

*Ch.* A quadrilateral having its opposite sides parallel is called (T. give term) a *parallelogram.* (Simultaneous recitation. T. write on board.)

*T.* (Presenting *square.*) What is this?

*Ch.* That is a parallelogram because its opposite sides are parallel.

*T.* Compare the sides with each other in regard to length.

*Ch.* The sides are equal in length. (Class decision. T. confirm.)

*T.* How many of the sides are equal?

*Ch.* All the sides are equal. (Class decision. T. confirm.)

*T.* What kind of angles has this parallelogram?

*Ch.* That parallelogram has right angles. (Class decision. T. confirm.)

*T.* How many of these angles are right angles?

*Ch.* All the angles of that parallelogram are right angles. (Class decision. T. confirm.)

*T.* Describe this parallelogram fully.

*Ch.* That parallelogram has all its sides equal, and all its angles right angles. (Class decision. T. confirm.)

*T.* Look round the room and find other parallelograms of which this is true. (Ch. finds several, describing each.)

*T.* Make on the board three such parallelograms, describe each, and then make the definition.

*Ch.* (After describing.) A parallelogram having all its sides equal, and all its angles right angles, is called (T. give term) a *square.* (Simultaneous recitation. T. write on board.)

*T.* (Presenting a rhomb.) What is this?

*Ch.* That is a parallelogram.

*T.* How does it resemble a square?

*Ch.* All its sides are equal. (Class decision. T. confirm.)

*T.* How does it differ from a square?

*Ch.* All its angles are not right angles.

*T.* How many right angles has it?

*Ch.* It has no right angles. (Class decision. T. confirm.)

*T.* What kind of angles has it?

*Ch.* It has two acute angles and two obtuse angles. (Class decision. T. confirm.)

*T.* What do you call two objects of the same kind?

*Ch.* We call them a pair. (Class decision. T. confirm.)

NOTE.—If child does not know word *pair*, T. refers to two gloves she wears, two shoes, etc., and gets word *pair.*

*T.* How many acute angles has this parallelogram?

*Ch.* It has one pair of acute angles.

*T.* And how many obtuse angles has it?

*Ch.* It has one pair of obtuse angles.

*T.* What kind of angles are the acute angles, thinking of their position in regard to each other?

*Ch.* They are opposite angles. (Class decision. T. confirm.)

*T.* And what kind are the obtuse angles?

*Ch.* They are opposite.

*T.* Now, who can fully describe this parallelogram?

*Ch.* That parallelogram has all its sides equal, and has one pair of opposite angles obtuse and the other pair acute. (Class decision. T. confirm.)

*T.* (Giving different children scissors and paper.) Make parallelograms of which this is true. (Children do so, describing, while other children make the same on the board and describe.)

*T.* What do we need now?

*Ch.* We need the definition and the name. (Class decision. T. confirm.)

*T.* Who can make the definition?

*Ch.* A parallelogram having all its sides equal, and having one pair of opposite angles obtuse and the other pair acute, is called (T. give term) a *rhomb*. (Simultaneous recitation. T. write on board.) Drill by having children find different forms and identify; by having them find them in the room, and make them with paper; and by having them read and copy definitions on the board. Then erase work, remove objects, close books, and have children recall what they have learned.)

### As Work in Inventive Drawing.

1. Make a square, and ornament it with triangles.
2. Make a design consisting of rhombs.
3. Ornament a square with curved lines.
4. Ornament a rhomb with isosceles triangles.

Note. — Teacher may, at the close of this lesson, teach *rectangle*, or may leave it until she closes work upon parallelograms.

The teacher may now require the children to begin to make each a set of forms for himself, cutting them first from paper, and afterwards from wood. If possible, *boys* and *girls* should make them from wood. It would be well to procure a set of tools for the school, while all bits of paper and wood should be saved as material with which to work.

## LESSON X.

Review *Quadrilateral, Parallelogram, Square,* and *Rhomb.*

**OBJECT.**

To cultivate *Perception, Conception, Comparison, Memory,* and *Language.*

**POINT.**

To develop idea of, and teach, *Oblong, Rhomboid, Trapezoid, Trapezium,* and *Polygon.*

**MATTER.**

1. *A parellelogram having one pair of its opposite sides longer than the other pair, and having all its angles right angles, is called an oblong.*
2. *A parallelogram having one pair of its opposite sides longer than the other pair, and having one pair of its opposite angles acute, and the other pair obtuse, is called a rhomboid.*
3. *A quadrilateral having one pair of its opposite sides parallel, and the other pair not parallel, is called a trapezoid.*
4. *A quadrilateral having none of its sides parallel is called a trapezium.*
5. *A space enclosed by three or more sides is called a polygon.*

**METHOD.**

*Teacher.* (Presenting oblong.) What is this?

*Child.* That is a parallelogram.

*T.* Compare the sides with regard to length.

*Ch.* One pair of sides is longer than the other pair. (Class decision. T. confirm.)

*T.* Thinking of their position in regard to each other, what kind of sides may you call this longer pair?

*Ch.* They are opposite sides.

*T.* Now make the statement that was made a moment ago.

*Ch.* One pair of opposite sides is longer than the other pair of opposite sides.

*T.* What kind of angles has it?

*Ch.* It has right angles.

*T.* How many of its angles are right angles?

*Ch.* All its angles are right angles.

*T.* Now who can fully describe this parallelogram?

*Ch.* That parallelogram has one pair of opposite sides longer than the

other pair, and all its angles are right angles. (Class decision. T. confirm.)

*T.* Find (or make) other parallelograms of which this is true. (Ch. find [or make] several, describing each time.)

*T.* Who can make the definition based upon that description?

*Ch.* A parallelogram having one pair of opposite sides longer than the other pair, and having all its angles right angles, is called (T. give term) an *oblong.* (Simultaneous recitation. T. write on board.)

*T.* (Presenting rhomboid.) Look carefully at this form and describe it as fully as you can.

*Ch.* That parallelogram has one pair of opposite sides longer than the other pair, and one pair of opposite angles obtuse, and the other pair acute. (Class decision. T. confirm.)

NOTE.—If the previous work has been thoroughly done, the teacher will have no trouble in getting the child to make this full description. In case he should fail, however, it will be necessary to go through the development questions, as in the work upon the oblong.

*T.* Find (or make) other parallelograms of which this is true. (Children find several; others make several on the board, and cut them from paper; while others describe each.)

*T.* Who can make the definition from the description?

*Ch.* A parallelogram having one pair of opposite sides longer than the other pair, and having one pair of opposite angles acute and the other pair obtuse, is called (T. give term) a rhomboid. (Simultaneous recitation. T. write on board.)

*T.* (Presenting trapezoid.) What is this?

*Ch.* It is not a parallelogram. (Class decision. T. confirm.)

*T.* I asked you what it *is*. Thinking of the number of sides, what may you call it?

*Ch.* It is a quadrilateral. (Class decision. T. confirm.)

*T.* Look at its sides carefully and tell me how many are parallel.

*Ch.* One pair of its sides are parallel. (Class decision. T. confirm.)

*T.* What kind of sides are those, thinking of their position in regard to each other?

*Ch.* They are opposite sides.

*T.* What is true of the other pair of opposite sides?

*Ch.* They are not parallel.

*T.* Now describe carefully all that you have learned about this quadrilateral.

*Ch.* That quadrilateral has one pair of its opposite sides parallel and the other pair not parallel.

*T.* Make other quadrilaterals of which this is true. (Children do so, describing each.)

*T.* Who can make the definition?

*Ch.* A quadrilateral having one pair of its opposite sides parallel, and the other pair not parallel, is called (T. give term) a *trapezoid.* (Simultaneous recitation. T. write on board.)

*T.* (Presenting trapezium.) What is this?

*Ch.* That is a quadrilateral.

*T.* And how many of its sides are parallel?

*Ch.* None of its sides are parallel. (Class decision. T. confirm.)

*T.* Draw on the board a quadrilateral of this kind, while others make two or three from paper. (Children do so, others describing fully.)

*T.* Now we are ready for the definition.

*Ch.* A quadrilateral having none of its sides parallel is called (T. give term) a *trapezium.* (Simultaneous recitation. T. write on board.)

NOTE.—T. may, if she has not already done so, teach *rectangle*, and show that the square and oblong come under this name, while the rhomb and rhomboid may be called *oblique-angled parallelograms.*

*T.* We have had in the two (or three) last lessons spaces enclosed by how many sides?

*Ch.* We have had spaces enclosed by four sides.

*T.* And before that we studied spaces enclosed by how many sides?

*Ch.* Before that we studied spaces enclosed by three sides. (Class decision. T. confirm.)

*T.* Think carefully, and tell me what is the smallest number of sides that will enclose a space.

*Ch.* (Trying to enclose a space.) Three is the smallest number of sides that will enclose a space. (Class decision. T. confirm.)

*T.* Enclose a space by more than four sides. (Children do so, stating: This space is enclosed by five sides, This space is enclosed by six sides, etc.)

*T.* (To board.) What have we here?

*Ch.* That is a space enclosed by three sides.

*T.* (To another figure.) And here?

*Ch.* That is a space enclosed by four sides; that one is enclosed by five sides; and that one by six sides.

*T.* I shall call the first A; the second B; the third C; and the fourth D. Now we want a name for a space enclosed by *three, four, five,* or *six* sides. Who can make the definition?

*Ch.* A space enclosed by three or more sides is called (T. give term) a *polygon.* (Simultaneous recitation. T. write on board.)

*T.* (To triangle.) What is this?

*Ch.* It is a polygon having three sides.

*T.* By what other name do you know it?

*Ch.* It is a triangle.

*T.* (To quadrilateral.) What is this?

*Ch.* It is a polygon having four sides, and we call it a *quadrilateral.*

*T.* To-morrow we shall find a name for a polygon having five, six, seven, eight, or nine sides. You may be thinking about them, and may bring me one of each kind made of paper.

Drill by having children select and name different forms, by having them make them, and by reading and copying definitions from the board. Then erase work and have children recall what they have learned.

### Work in Inventive Drawing.

1. Make a design in which trapezoids and triangles are combined.
2. Ornament a trapezium with acute-angled triangles.
3. Make a design in which the rhomb and square are combined.
4. Make a design using three different kinds of polygons. Designs for brackets, wall-pockets, or braiding may be made.

## LESSON XI.

Review *Oblong, Rhomboid, Trapezoid, Trapezium,* and *Polygon.*

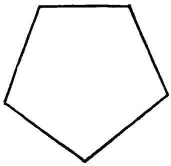
**OBJECT.**

To cultivate *Perception, Conception, Comparison, Memory,* and *Language.*

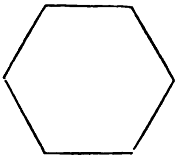
**POINT.**

To develop idea of, and teach, *Pentagon, Hexagon, Heptagon, Octagon,* etc., *Regular Polygon* and *Diagonal.*

**MATTER.**



1. *A polygon having five sides is called a pentagon.*
2. *A polygon having six sides is called a hexagon.*
3. *A polygon having seven sides is called a heptagon.*
4. *A polygon having eight sides is called an octagon.*
5. *A polygon having equal sides and equal angles is called a regular polygon.*
6. *A line drawn from the vertex of one angle in a polygon to the vertex of another angle, not adjacent, is called a diagonal of that polygon.*



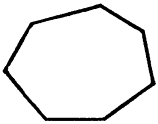
**METHOD.**

*Teacher.* (Presenting pentagon.) What is this?

*Child.* That is a polygon having five sides.

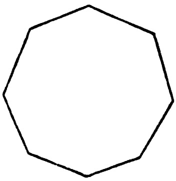
*T.* Who knows a name for it?

*Ch.* A polygon having five sides is called (T. give term) a *pentagon.* (Simultaneous recitation. T. write on board.)



*T.* (Presenting hexagon.) Without making a description, make a definition that will suit this.

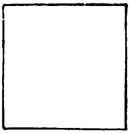
*Ch.* A polygon having six sides is called (T. give term) a *hexagon.* (Simultaneous recitation. T. write on board.)



*T.* (Presenting heptagon.) Make a definition to suit this.

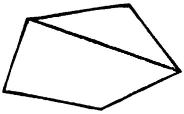
*Ch.* A polygon having seven sides is called (T. give term) a *heptagon.* (Simultaneous recitation. T. write on board.)

*T.* (Presents octagon without speaking.)



*Ch.* A polygon having eight sides is called (T. give term) an *octagon*. (Simultaneous recitation. T. write on board.)

NOTE. — T. may here get, by presenting forms, definitions of *nonagon*, *decagon*, etc. No new development work is needed for these terms.



*T.* (Presenting irregular polygon.) I wish you to compare the sides of this polygon with each other, and tell me what you observe.

*Ch.* Some of the sides of that polygon are longer than others. (Class decision. T. confirm.)

*T.* Since that is true, what kind of sides may you call them?

*Ch.* They are unequal. (Class decision. T. confirm.)

*T.* Now compare the angles of this polygon with one another, and tell me what you observe.

*Ch.* The angles are unequal also. (Class decision. T. confirm.)

*T.* Now describe this polygon.

*Ch.* That polygon has unequal sides and unequal angles.

*T.* (Presenting regular polygon.) Compare the sides and angles of this polygon.

*Ch.* That polygon has equal sides and equal angles. (Class decision. T. confirm.)

*T.* Find other polygons having equal sides and equal angles. (Children find some among forms, some make them on board, others make them with paper, while others describe those made.)

*T.* Think of some polygon that you have seen that has equal sides and equal angles.

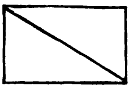
*Ch.* An equilateral triangle and a square have equal sides and equal angles. (Class decision. T. confirm.)

*T.* Who can make the definition that we need?

*Ch.* A polygon having equal sides and equal angles is called (T. give term) a *regular polygon*. (Simultaneous recitation. T. write on board.)

*T.* (Drawing a diagonal in a quadrilateral.) What have I done?

*a* *b*



*d* *c*

*Ch.* You have drawn a line *ac* in the polygon *abcd*.

*T.* From where to where have I drawn it?

*Ch.* You have drawn it from the angles *dab* to the angle *dcb*.

*T.* From what part of the angle *dab* have I drawn it?

*Ch.* You have drawn it from the vertex of the angle *dab* to the vertex of the angle *dcb*. (Class decision. T. confirm.)

*T*. Thinking of their position in regard to the line *ab*, what kind of angles are *dab* and *cba*?

*Ch*. Angles *dab* and *cba* are adjacent angles. (Class decision. T. confirm.)

*T*. Then what is true of angles *dab* and *deb* in this respect?

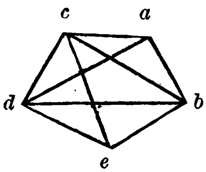
*Ch*. They are not adjacent. (Class decision. T. confirm.)

*T*. Find angles in this polygon that are adjacent.

*Ch*. Angles *cda* and *dab* are adjacent, and *ade* and *dcb* are adjacent. (Class decision. T. confirm.)

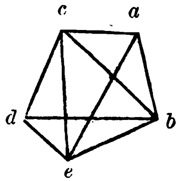
*T*. Now tell me where I have drawn the line *ac*.

*Ch*. You have drawn line *ac* from the vertex of one angle *dab*, in the polygon, to the vertex of another angle *dcb*, not adjacent. (Class decision. T. confirm.)



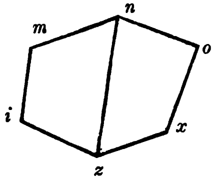

*T*. (Drawing diagonal in a pentagon.) What have I done now?

*Ch*. You have drawn a line *db* from the vertex of one angle *abe*, in the polygon *cabed*, to the vertex of another angle *cde*, not adjacent. (Class decision. T. confirm.)




*T*. (Drawing diagonal in a hexagon.) What have I done now?

*Ch*. You have drawn a line *nz* from the vertex of one angle *mno*, in a polygon, to the vertex of another angle *izx*, not adjacent. (Class decision. T. confirm.)




*T*. For what are we now ready?

*Ch*. We are ready for a definition and a name.

*T*. Who can make the definition?

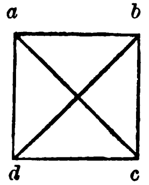
*Ch*. A line drawn from the vertex of one angle in a polygon to the vertex of another angle not adjacent is called (T. give term) a *diagonal* of that polygon. (Simultaneous recitation. T. write on board.)

Drill, by having children make, or select from among forms, regular and irregular polygons, regular and irregular pentagons, hexagons, heptagons, etc.; and by having them read and copy definitions from the board. Then erase work, close books, remove objects, and have children recall what they have learned.

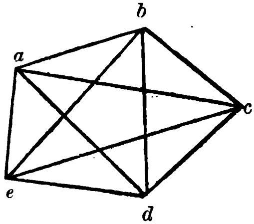
### Work in Inventive Drawing.

1. Ornament a hexagon with curved lines.
2. Make a design composed of regular pentagons.
3. Ornament a heptagon with triangles.

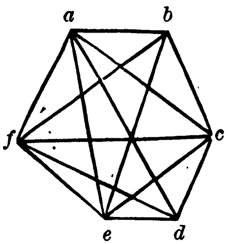
NOTE.—If the teacher intends carrying on the work in Geometry, he may now teach angles in relation to polygons; viz.: *interior*, *exterior*, and *reëntrant* angles, and may assign such elementary problems for solution as the following:—



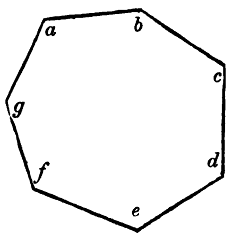

1. Find the greatest number of diagonals that can be drawn in a *quadrilateral*, in a *pentagon*, in a *hexagon*, in a *heptagon*, etc.
2. Find the rule.
3. How many and what kind of figures have you made by drawing these diagonals?




1. In the quadrilateral?
2. In the pentagon?
3. In the hexagon?
4. In the heptagon?
5. How many interior angles can be made in a polygon?
6. What is the greatest number of reëntrant angles that can be made in any polygon, quadrilateral, pentagon, hexagon, heptagon?
7. What is the greatest number of exterior angles in any polygon, triangle, quadrilateral, pentagon, hexagon, heptagon?




8. How does one exterior angle of a triangle compare with the interior angles of the same triangle? or prove that one exterior angle of a triangle equals the sum of the two interior angles not adjacent.
9. What is the value of the sum of the interior angles of a triangle?
10. What is the value of the sum of the interior angles of any polygon?




11. What is the value of the sum of the exterior angles of any polygon?
12. How does the reëntrant angle of a quadrilateral compare with the interior angles not adjacent?

Review carefully all work upon straight-line figures.

## LESSON XII.

It would be well, before going farther, to spend several days in reviewing work upon straight-line forms.

### CIRCLES.

**OBJECT.**

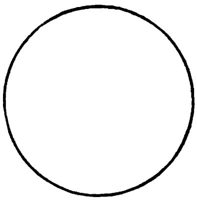
To cultivate *Perception*, *Conception*, *Comparison*, *Reason*, *Judgment*, and *Language*.

**POINT.**

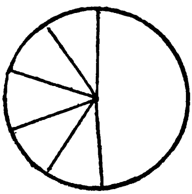
To develop idea of, and teach, *Circle*, *Circumference*, *Center*, *Arc*, *Semi-Circumference*, and *Quadrant*.

**MATTER.**

1. *A space enclosed by a curved line, all points of which are equally distant from one point within, is called a circle.*
2. *The curved line is called the circumference.*
3. *The point within the circle, from which all points in the circumference are equally distant, is called the center of a circle.*
4. *A part of the circumference is called an arc of a circle.*
5. *An arc which is half a circumference is called a semi-circumference.*
6. *An arc that is one quarter of a circumference is called a quadrant.*



**METHOD.**



*Teacher.* (Describing a circle.) What have I done?

*Child.* You have drawn a curved line.

*T.* By drawing this curved line in this way, what have I done?

*Ch.* You have enclosed a space.

*T.* (Touching center.) What have I done?

*Ch.* You have touched a point in (within) the space.

*T.* (Drawing radius.) What have I done now?

*Ch.* You have drawn a line from the point within the space to a point in the curved line. (Class decision. T. confirm.)

*T.* (Drawing another line.) What have I done now?

*Ch.* You have drawn another line from the point within to a point in the curved line.

*T.* How do those lines compare in length?

*Ch.* They are equal. (Class decision. T. confirm.)

*T.* What do these lines show?

*Ch.* They show distance from points in the curved line to a point within the space. (Class decision. T. confirm.)

*T.* How do these points in the curved line compare with each other in regard to distance from the point within?

*T.* (Drawing other lines.) What have I done?

*Ch.* You have drawn other lines, showing distances from points in the curved line to the point within. (Class decision. T. confirm.)

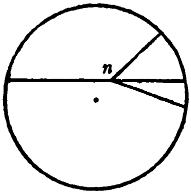
*T.* How do those distances compare with the others and with one another?

*Ch.* They are the same. (Class decision. T. confirm.)

*T.* If I were to draw other lines from points in the curved line to this point within, what would be true of the distance of those points from the point within?

*Ch.* All points in the curved line would be equally distant from the point within the space. (Class decision. T. confirm.)

*T.* Suppose I should take another point *n* within the space, tell me whether all points in the curved line are equally distant from that point within?




*Ch.* All points in the curved line are unequally distant from that point within the space. (Class decision. T. confirm.).

*T.* How many points within the space are there from which all points in the curved line are equally distant?

*Ch.* There is only one such point. (Class decision. T. confirm.)

*T.* Thinking of that, you may describe this space as fully as you can.

*Ch.* That is a space enclosed by one curved line, all points of which are equally distant from one point within. (T. aids Ch. in the construction. "All points of which," being rather unnatural to a child.)

*T.* Who else can make a space of this kind and describe? (Ch. makes one on the board as nearly like as possible, and describes.)

*T.* Who can make the definition to suit that description?

*Ch.* A space enclosed by a curved line, all points of which are equally distant from a point within, is called (T. give term) a *circle.* (Simultaneous recitation. T. write on board.)

*T.* Show me which part is the circle.

*Ch.* The space is the circle.

*T.* (To circumference.) What is this?

*Ch.* That is the curved line which bounds the circle.

*T.* Who knows what it is called?

*Ch.* The curved line is called (T. give term) the *circumference.* (Simultaneous recitation. T. write on board.)

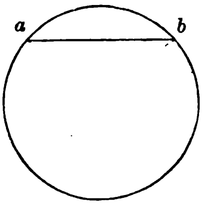
*T.* (To center.) What is this?

*Ch.* That is the one point within the circle from which all points in the circumferance are equally distant. (Class decision. T. confirm.)

*T.* Who knows a name for this point?

*Ch.* The point within the circle from which all points in the circumference are equally distant is called (T. give term) the *center* of a circle. (Simultaneous recitation. T. write on board.)

a b



c

*T.* (Touching circumference.) What have I done?

*Ch.* You have taken point *a* in the circumference.

*T.* (Touching another point.) What have I done now?

*Ch.* You have taken another point *b* in the circumference.

*T.* (Joining *a* and *b.*) What have I done now?

*Ch.* You have joined *a* and *b* by a straight line.

*T.* What have I done to the circumference?

*Ch.* You have divided it into two parts.

*T.* (To *a, b.*) What is *ab* of the circumference?

*Ch.* It is a part of the circumference.

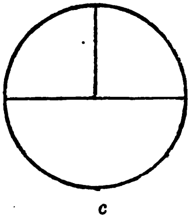
*T.* And what is *acb*?

*Ch.* *acb* is a part of the circumference.

*T.* Who knows what a part of the circumference is called?

*Ch.* A part of the circumference is called (T. give term) an *arc.* (Simultaneous recitation. T. write on board.)

d

a  b

c

*T.* (Drawing diameter.) What have I done to the circumference now?

*Ch.* You have divided the circumference into two arcs, *adb* and *acb.* (Class decision. T. confirm.)

*T.* How does arc *adb* compare with arc *acb*?

*Ch.* Arc *adb* is equal to arc *acb.* (Class decision. T. confirm.)

*T.* To how much of the circumference is arc *adb* equal?

*Ch*. Arc *adb* is equal to one-half of the circumference, and arc *acb* is equal to one-half of the circumference.

*T*. Make a definition to suit that description.

*Ch*. An arc that is equal to one-half of a circumference is called (T. give term) a *semi-circumference*. (Simultaneous recitation. T. write on board.)

*T*. (Drawing radius.) What have I done to the semi-circumference *adb*?

*Ch*. You have divided it into two parts, *ad* and *db*.

*T*. What may you call *ad*?

*Ch*. It is an arc.

*T*. How does arc *ad* compare with arc *db*?

*Ch*. Arc *ad* is equal to arc *db*. (Class decision. T. confirm.)

*T*. How does arc *ad* or *db* compare with the semi-circumference *adb* or *acb*?

*Ch*. Arc *ad* or *db* is equal to one-half the semi-circumference *adb* or *acb*. (Class decision. T. confirm.)

*T*. How does arc *ad* or *db* compare with the whole circumference?

*Ch*. Arc *ad* or *db* is equal to one-quarter of the whole circumference. (Class decision. T. confirm.)

*T*. Who can make the definition we need?

*Ch*. An arc that is one-quarter of a circumference is called (T. give term) a *quadrant*. (Simultaneous recitation. T. write on board.)

Drill by having pupils make different parts and identify, and by having them read and copy definitions. Then erase work and have them recall what they have learned.

### Work in Inventive Drawing.

1. Make a design consisting of circles.
2. Make a border of circles.
3. Ornament a circle with arcs.

## LESSON XIII.

Review *Circle, Circumference, Center, Arc, Semi-Circumference,* and *Quadrant.*

**OBJECT.**

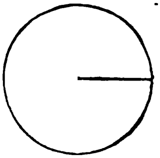
To cultivate *Perception, Conception, Comparison, Reason, Judgment,* and *Language.*

**POINT.**

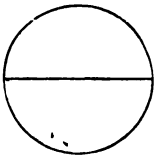
To develop idea of, and teach, *Radius, Diameter, Chord, Tangent.*

**MATTER.**

1. *A line drawn from the center to a point in the circumference of a circle is called a radius.*

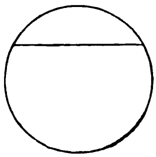


2. *A line drawn from one point in the circumference, through the center to another point in the circumference of a circle, is called a diameter of a circle.*
3. *A line which is drawn from one point in the circumference to another point in the circumference of a circle, and does not pass through the center, is called a chord of a circle.*

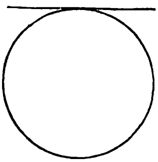


4. *A line drawn so as to touch the circumference of a circle in but one place is called a tangent of a circle.*

**METHOD.**

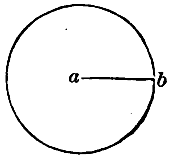


*Teacher.* (Describing circle.) What have I done?
*Child.* You have made a circle.
*T.* (Drawing radius.) What have I done now?
*Ch.* You have drawn a line *ab.*
*T.* From where to where have I drawn it?
*Ch.* You have drawn it from the center of the circle to a point in the circumference.

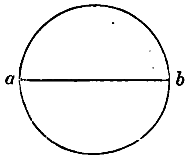


*T.* You may make a circle and draw a line similar to *ab.* (Child does so, stating, I have drawn a line from the center to a point in the circumference of this circle.)
*T.* Who can make a definition from that description?

*Ch.* A line drawn from the center to a point in the circumference of a circle is called (T. give term) a *radius.* (Simultaneous recitation. T. write on board.) (T. explains that the plural of *radius* is *radii;* then drawing other *radii* in the same and in equal circles, also in circles unequal to the first, she has the pupils compare, and leads them to the conclusion that *all radii in the same or equal circles are equal.*)




*T.* (Describing circle and drawing diameter.) What have I done?




*Ch.* You have made a circle, and drawn a line in it.

*T.* From where to where have I drawn the line?

*Ch.* You have drawn the line from one point in the circumference to another point in the circumference.

*T.* Where is that line in regard to the center?

*Ch.* It passes through the center. (Class decision. T. confirm.)

*T.* Describe that line fully, as to where it is drawn.

*Ch.* That line is drawn from one point in the circumference through the center to another point in the circumference.

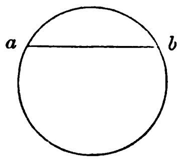
*T.* You may draw a line in a circle in the same way. (Ch. does so, stating what he has done.)

*T.* Who can make a definition to suit the description?

*Ch.* A line drawn from one point in the circumference through the center to another point in the circumference of a circle is called (T. give term and explain meaning) a *diameter* of a circle. (Simultaneous recitation. T. write on board. T. here leads children to state that a diameter is equal in length to two radii, and that all diameters in the same or equal circles are equal.)

*T.* (Drawing chord in a circle.) What have I done?

*Ch.* You have drawn a line from one point in the circumference to another point in the circumference of a circle.




*T.* Where is this line in regard to the center?

*Ch.* It does not pass through the centre.

*T.* Describe this line fully, thinking of where it is drawn.

*Ch.* That line is drawn from one point in the circumference to another point in the circumference of a circle, and does not pass through the center. (Class decision. T. confirm.)

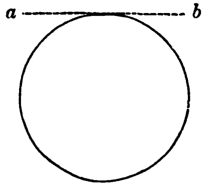
*T.* You may draw another line in the same circle similar to the one I have drawn, and describe. (Ch. does so, describing fully.)

*T.* What do we need now?

*Ch.* We need a definition and a name.

*T.* You may make the definition.

*Ch.* A line which is drawn from one point in the circumference to another point in the circumference of a circle, and does not pass through the center, is called (T. give term) a *chord* of a circle. (Simultaneous recitation. T. write on board. T. may show that a diameter, according to this definition, is not a chord, though it is *sometimes called* the greatest chord in a circle.)




*T.* (Drawing a tangent.) What have I done?

*Ch.* You have made a circle and drawn a line *ab*.

*T.* Where is the line in regard to the circle?

*Ch.* It is outside of the circle (near to the circle).

*T.* How near the circle is it?

*Ch.* It touches the circumference.

*T.* In how many places does it touch the circumference?

*Ch.* It touches the circumference in one place.

*T.* Tell me whether you think it can be made to touch the circumference in more than one place?

*Ch.* It can touch the circumference in but one place.

*T.* Draw a line similar to this, and describe. (Child does so, stating: This line touches the circumference in but one place.)

*T.* Now you may make the definition based on that description.

*Ch.* A line drawn so as to touch the circumference of a circle in but one place is called (T. give term) a *tangent* of a circle. (Simultaneous recitation. T. write on board.)

Drill by having children make circles, draw and describe different lines, and by having them copy and read definitions on the board. Then erase work, remove objects, and have them recall what they have learned?

### Work in Inventive Drawing.

1. Make a design in circles, ornamenting with curved lines.
2. Ornament a circle with chords.
3. Ornament a circle with triangles.
4. Ornament a circle with arcs.
5. Make a design in quadrants.

### Questions for Geometry.

1. What is the gratest number of *radii* that can be made in a circle of diameters?
2. Greatest number of spaces that can be made by the intersection of two circles, of three, of four, of five, of six?

## LESSON XIV.

Review *Radius, Diameter, Chord,* and *Tangent.*

**OBJECT.**

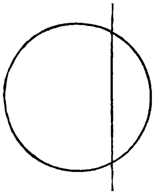
To cultivate *Perception, Conception, Comparison, Reason, Judgment,* and *Language.*

**POINT.**

To develop idea of, and teach, *Secant, Semicircle, Segment,* and *Sector.*

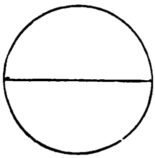
**MATTER.**

1. *A line which intersects (cuts) the circumference of a circle in two points is called a secant.*



2. *A space enclosed by the semi-circumference and the diameter of a circle is called a semicircle.*
3. *A space enclosed by an arc and a chord of a circle is called a segment of a circle.*
4. *A space enclosed by two radii and the intercepted arc is called a sector of a circle.*

**METHOD.**

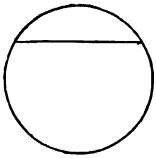


*Teacher.* (Describing circle and drawing secant.) What have I done?

*Child.* You have made a circle and drawn a line.

*T.* Where is the line in regard to the circle?

*Ch.* The line passes through the circle. (Class decision. T. confirm.)



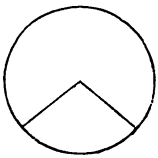
*T.* And what does this line do to the circumference?

*Ch.* The line crosses the circumference.

*T.* Tell me that, using another word instead of *crosses.*

*Ch.* The line *cuts* the circumference.

*T.* Who can use another word that means the same as *cuts?*



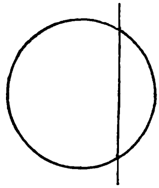
*Ch.* (or *T.*) *Intersects.*

*T.* In how many points does this line intersect the circumference?

*Ch.* That line intersects the circumference in two points.

*T.* You may describe a circle and draw a line similar to this. (Ch. does so, stating: This line intersects the circumference in two points.)

*T.* Who can draw a straight line that will intersect the circumference in more than two points?



*Ch.* We cannot draw a straight line that will intersect the circumference in more than two points. (Class decision. T. confirm.)

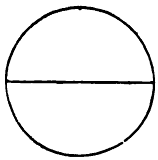
*T.* Now, for what are we ready?

*Ch.* We are ready for the definition.

*T.* Very well, make the definition.

*Ch.* A line that intersects the circumference of a circle in two points is called (T. give term) a *secant*. (Simultaneous recitation. T. write on board.)

*T.* (Describing a circle and drawing diameter.) What have I done?



*Ch.* You have made a circle and drawn a diameter.

*T.* (Tracing the semi-circumference.) What is this?

*Ch.* That is the semi-circumference. (Class decision. T. confirm.)

*T.* (Pointing to space.) What is this?

*Ch.* That is a space.

*T.* By what is this space enclosed?

*Ch.* That space is enclosed by the semi-circumference and the diameter of the circle. (Class decision. T. confirm.)

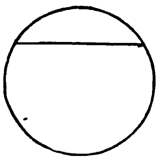
*T.* (Pointing to the other space.) By what is this space enclosed?

*Ch.* That space is enclosed by the semi-circumference and the diameter of the circle.

*T.* You may make other spaces enclosed by the semi-circumference and the diameter of a circle. (Child does so, describing fully.)

*T.* Who can make the definition that we need now?

*Ch.* A space enclosed by the semi-circumference and the diameter of a circle is called (T. give term) a *semicircle*. (Simultaneous recitation. T. write on board.)



*T.* (Describing circle and drawing chord.) What have I done now?

*Ch.* You have made a circle and drawn a chord.

*T.* (Tracing arc.) What is this?

*Ch.* That is an arc.

*T.* (To space.) What is this?

*Ch.* That is a space.

*T.* By what is this space enclosed?

*Ch.* That space is enclosed by an arc and a chord. (Class decision. T. confirm.)

*T.* (To the other space.) By what is this space enclosed?

*Ch.* That space is enclosed by an arc and a chord. (Class decision. T. confirm.)

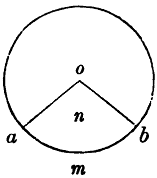
*T.* Show me other spaces enclosed by an arc and a chord. (Ch. does so, stating fully.)

*T.* Who can make the definition?

*Ch.* A space enclosed by an arc and a chord of a circle is called (T. give term) a *segment* of a circle. (Simultaneous recitation. T. write on board.)

*T.* (Describing circle and drawing two radii.) What have I done now?

*Ch.* You have made a circle and drawn two radii.




*T.* (To space *n*.) What is this?

*Ch.* That is a space.

*T.* By what is this space enclosed?

*Ch.* That space is enclosed by two radii and the arc *amb*. (Class decision. T. confirm.)

*T.* Where is the arc *amb* in regard to the radii *oa* and *ob*?

*Ch.* The arc *amb* is between the points *a* and *b*, or it is cut off by the radii *oa* and *ob*. (Class decision. T. confirm.)

*T.* Thinking of this, what may we say of this arc *amb*?

*Ch.* (or *T.*) It is included between *oa* and *ob*, or it is the intercepted arc. (T. explain the use of the word.)

*T.* Now describe the space *n*?

*Ch.* It is a space enclosed by two radii and the intercepted arc.

*T.* Show me other spaces enclosed in the same way. (Ch. does so, stating: This space is enclosed by two radii and the intercepted arc.)

*T.* Now we are ready for the definition.

*Ch.* A space enclosed by two radii and the intercepted arc is called (T. give term) a *sector* of a circle. (Simultaneous recitation. T. write on board.)

Drill by having children find and describe *tangent*, *segment*, *semicircle*, and *sector;* by having pupils cut forms in paper and describe, and by having them read and copy definitions on the board. Then erase work, remove objects, close books, and have pupils recall what they have learned.

NOTE.—If the children are able to make the description of ellipse, and to construct the definition, they may do so now. If not, the form for the present may be presented and the name given. The oval may be taught now. It is very simple, and both description and definition may be given. Before beginning work upon solids, review all the previous work in form. Let several days be spent in the review, and be careful to have the children understand as well as remember.

### WORK IN INVENTIVE DRAWING.

1. Make a design in segments of circles.
2. Make a design in tangents and secants.
3. Make a design, using sectors of circles.

### WORK IN GEOMETRY.

1. Make in a circle an angle, two of whose sides are radii (*central* angle.)
2. Construct an angle, two of whose sides are chords of a circle (*inscribed* angle).
3. Make a polygon, all of whose sides are chords of a circle (*inscribed* polygon).
4. Make a polygon, all of whose sides are tangents of a circle (*circumscribed* polygon).
5. To what class of angles does an angle inscribed in a semicircle belong?
6. To what class does an angle inscribed in a segment less than a semicircle belong?
7. An angle inscribed in a segment greater than a semicircle?

## LESSON XV.

### Solids.

With very young pupils, it would be well to begin "Form" with a study of "Solids." The pupils may handle the objects, giving such descriptions as their limited language will allow, and using the terms given them by the teacher. In this way they will learn to distinguish the different solids, and to give partial descriptions that will be of use later. The solids, as studied, should be moulded by the children in clay or putty. The work of moulding may be carried into older classes with great advantage, and will be of great service in drawing. The order of work may, or may not, be the same for primary and advanced work. The order here given takes in all the solids having curved surfaces first, and afterward the solids having plane faces or surfaces.

**OBJECT.**

To cultivate *Perception, Conception, Comparison, Reason, Judgment, Memory,* and *Language.*

**POINT.**

To develop idea of, and teach, *Solid, Sphere, Hemisphere, Diameter* of a *Sphere,* and *Cylinder.*

**MATTER.**

1. *An object that has length, breadth, and thickness, is a solid.*

2. *A solid bounded by a curved surface, every point of which is equally distant from a point called the center, is called a sphere.*
3. *A hemisphere is half a sphere.*
4. *A straight line passing through the center of a sphere, and terminated by the surface on opposite sides, is called the diameter of a sphere.*
5. *A solid bounded by two equal parallel plane circular bases and one curved face (between the bases) is called a cylinder.*

**METHOD.**

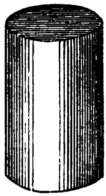
*Teacher.* (Presenting a solid.) How many dimensions has this solid?

*Child.* It has three dimensions.

*T.* Name them.

*Ch.* It has length, breadth, and thickness.

NOTE. — The teacher will remember that pupils are to be led to appreciate length, breadth, and thickness, before beginning the regular work in form.



*T.* Find other objects that have length, breadth, and thickness. (Children find several each, stating: This object has length, breadth, and thickness.)

*T.* What is an object that has length, breadth, and thickness called?

*Ch.* An object that has length, breadth, and thickness is called (Ch. or T. give term) a *solid.* (Simultaneous recitation. T. write on board. T. here lead children to state that a line is terminated by points, a surface is bounded by lines, and a solid is bounded by faces; or, as in the case of sphere and spheroid, etc., by a surface.)

*T.* (Presenting a sphere.) What is this?

*Ch.* It is a solid.

*T.* By what is it bounded? (Ch. may state: It is bounded by faces. If so, T. will correct.)

*Ch.* It is bounded by a surface.

*T.* By what kind of surface, thinking of its direction, is it bounded?

*Ch.* It is bounded by a curved surface.

*T.* (Opening the sphere, which ought to be composed of two hemispheres fastened by a hinge.) Observe what I do. (Marking a point in the surface near edge of hemisphere.) What have I done?

*Ch.* You have touched a point in the surface.

*T.* (Touching the central point in the plane of the circle of hemisphere.) What have I done?

*Ch.* You have touched a point inside.

*T.* I shall draw a line from the point I touched in the surface to that point inside. (Does so, and then takes another point in the surface.) What have I done now?

*Ch.* You have touched another point in the surface.

*T.* I draw another line from that point to the point inside. How does this line compare in length with the first?

*Ch.* It is the same length. (Class decision. T. confirm.)

*T.* What do these two lines show?

*Ch.* They show distances.

*T.* Distances from where to where?

*Ch.* They show distances from two points in the surface to a point within the solid.

*T.* How do the distances of those two points in the surface from the point within the solid compare in length?

*Ch.* Those two points in the surface are equally distant from the point within the solid. (Class decision. T. confirm.)

*T.* Suppose I take another point in the surface, how do the distances of the three points in the surface, from the points within, compare with each other?

*Ch.* The three points in the surface are equally distant from the point within the solid. (Class decision. T. confirm.)

*T.* How many points in the surface are equally distant from that point within the solid?

*Ch.* All points in the surface (or every point) are equally distant from that point within the solid. (Class decision. T. confirm.)

*T.* Now, if I take another point within the solid, how do the distances of all points in the surface from that point compare?

*Ch.* The points in the surface are unequally distant from that point. (Class decision. T. confirm.)

*T.* If I take another, what will be true in this respect?

*Ch.* The points in the surface are unequally distant from that point.

*T.* How many points are there within this solid from which all points in the surface are equally distant?

*Ch.* There is only one. (Class decision. T. confirm.)

*T.* What is that point called?

*Ch.* It is called the *center*.

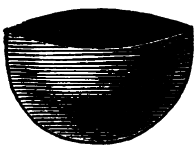
*T.* Thinking of what you have learned, describe this solid.

*Ch.* It is a solid bounded by a curved surface, every point of which is equally distant from a point within, called the center.

*T.* Find other solids of which this is true. (Children find several, ball, marble, etc., stating each time what he has found.)

*T.* Who can make the definition that is based on this description?

*Ch.* A solid bounded by a curved surface, every point of which is equally distant from a point within, called the center, is called (Ch. or T. give term) a *sphere*. (Simultaneous recitation. T. write on board.)



*T.* (Presenting hemisphere.) What is this?

*Ch.* That is one-half a sphere. (Class decision. T. confirm.)

*T.* Who knows what it is called? (Ch. or T. give term *hemisphere*.)

*T.* What is a hemisphere?

*Ch.* A hemisphere is half a sphere. (Simultaneous recitation. T. write on board.)

NOTE. — The teacher may lead the pupils to state that a hemisphere is bounded by a curved face and a plane face, which is a circle whose circumference is the circumference of the whole sphere.

*T.* (Presenting sphere dissected.) Observe and state what I do.

*Ch.* You made a straight line within the sphere.

*T.* Where is this line in regard to the center of the sphere?

*Ch.* It passes through the center of the sphere.

*T.* Where are the ends of the line?

*Ch.* We cannot see them.

*T.* Why not?

*Ch.* They are in the sphere. The line stops in the sphere.

*T.* By what is the line stopped (terminated)?

*Ch.* The line is terminated by the surface of the sphere.

*T.* In how many places is the line terminated?

*Ch.* In two places.

*T.* Where are they in regard to each other?

*Ch.* They are opposite each other.

*T.* Now describe this line.

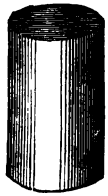
*Ch.* It is a straight line passing through the center of the sphere, and terminated by the surface at opposite points (sides).

*T.* Who can make the definition?

*Ch.* A straight line passing through the center of a sphere, and terminated by the surface on opposite sides, is called (T. or Ch. give term) the *diameter* of a sphere. (Simultaneous recitation. T. write on board.)

NOTE. — T. may here teach circumference of sphere, which can be easily shown (by showing edge of a hemisphere).

*T.* (Presenting a cylinder.) What is this?



*Ch.* It is a solid.

*T.* By what is it bounded?

*Ch.* It is bounded by two plane (flat) faces and one curved face. (Class decision. T. confirm.) (The word *plane*, taught in connection with lessons upon surface.)

*T.* How do the plane faces compare in size with each other?

*Ch.* They are equal. (Class decision. T. confirm.)

*T.* What kind of faces are they, thinking of their distance apart at all points?

*Ch.* They are parallel faces. (Class decision. T. confirm.)

*T.* And thinking of the direction of the circumference of each face, what kind of faces are they?

*Ch.* They are circles or circular faces.

*T.* Now, thinking of all you have learned about the two faces, describe this solid carefully.

*Ch.* That solid is bounded by two equal, parallel, plane, circular faces, and one curved face. (Class decision. T. confirm. T. may here lead children to state that the plane faces are *bases*, since the solid rests on either of them.)

*T.* Find other solids like this in every respect. (Children find several, stating what they have found.)

*T.* Who can make the definition based on this description?

*Ch.* A solid bounded by two equal, plane, parallel, circular bases, and one curved face, is called (Ch. or T. give term) a *cylinder*. (Simultaneous recitation. T. write on board. T. may teach right and oblique cylinders here, or may leave this for later work.)

Drill by having pupils find and name different solids, by having them give descriptions, make drawings, and read definitions on the board. (Copy in note-book.) Then erase work, remove objects, and have pupils recall what they have learned.

NOTE. — After teaching hemisphere, *spheroid* (prolate and oblate), *ovoid*, and *ellipsoid* may be taught. If, however, the children are young, these may be left till later.

## LESSON XIV.

Review carefully *Solid Sphere, Hemisphere, Diameter of Sphere,* and *Cylinder.*

**OBJECT.**

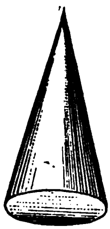
To cultivate *Perception, Conception, Comparison, Reason, Judgment, Memory,* and *Language.*

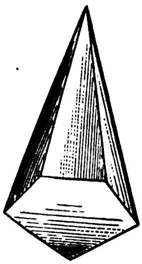
**POINT.**

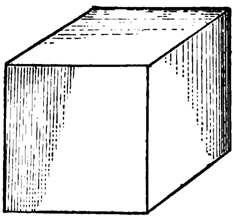
To develop idea of, and teach, *Cone, Pyramid, Cube,* and *Prism.*

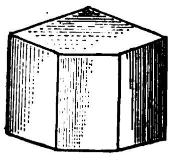
**MATTER.**

1. *A solid that has one plane circular base and one curved face that tapers to a point called the apex, is called a cone.*
2. *A solid that has one polygonal base and as many triangular side faces as the base has sides, all meeting at a point called the apex, is called a pyramid.*
3. *A solid that has six equal square faces is called a cube.*
4. *A solid that has two equal, plane, parallel, polygonal bases, and as many parallelogram side faces as each base has sides, is called a prism.*









**METHOD.**

*Teacher.* (Presenting a cone.) What is this?
*Child.* It is a solid.
*T.* You may describe it.
*Ch.* It has one plane face and one curved face.
*T.* What is the form of the plane face?
*Ch.* It is circular.
*T.* (Placing cone on table on base.) What else may you call the plane circular face?

*Ch.* We may call it a plane circular base.

*T.* You may now compare the curved face of this solid with the curved face of the cylinder, and state any difference you observe.

*Ch.* The curved face of this solid comes to a point, and the curved face of the cylinder does not. (Class decision. T. confirm.)

*T.* What word may we use instead of *cones?*

*Ch.* (or T.) *Tapers.*

*T.* What is this point called?

*Ch.* (or T.) It is called the apex.

*T.* Now describe this curved face.

*Ch.* This curved face tapers to a point called the apex.

*T.* Now, thinking of what you have learned, describe this solid.

*Ch.* This solid has one plane circular base, and one curved face that tapers to a point called the apex.

*T.* Find other solids of which this is true. (Children find or mould several, giving description of each.)

*T.* Who can make the definition based on that description?

*Ch.* A solid that has one plane circular base, and one curved face that tapers to a point called the apex, is called (Ch. or T. give term) a *cone.* (Simultaneous recitation. T. write on board.)

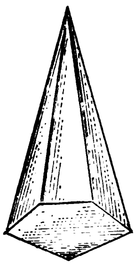
*T.* (Presenting a pyramid.) What is this?

*Ch.* It is a solid something like the cone.

*T.* In what points is it like the cone?

*Ch.* It has one plane base, and it has an apex. (Class decision. T. confirm.)

*T.* How does it differ from the cone?



*Ch.* The cone has one curved face, and this solid has several plane faces. (Class decision. T. confirm.)

*T.* Examine first the base, and tell me to what class of figures it belongs.

*Ch.* It is a pentagon.

*T.* Why do you call it a pentagon?

*Ch.* Because it has five sides.

*T.* Then what kind of base is it?

*Ch.* It is a plane pentagonal base.

*T.* And how many side faces are there?

*Ch.* There are five side faces.

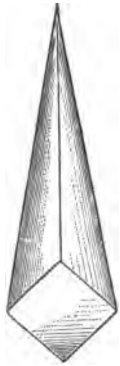
*T.* What is the form of each?

*Ch.* Each side face is a triangle.

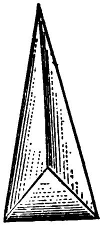
*T.* How does the number of triangular side faces compare with the sides of the base?

*Ch.* The number of triangular side faces is the same as the number of sides of the bases.

*T.* Observe the base of this solid in regard to the number of sides.
*Ch.* The base of this solid has four sides.
*T.* And the base of this one?
*Ch.* This one has three sides.



*T.* Suppose you were to describe these bases as to form, without stating the number of sides of each, what one term would you apply to all?
*Ch.* I would say that they are *polygons.*
*T.* What kind of base has this solid?
*Ch.* It has one plane polygonal base.
*T.* And this?
*Ch.* It has one plane polygonal base, and so has the other. (Class decision. T. confirm.)
*T.* And how does the number of side faces of each compare with the number of sides of bases?
*Ch.* The side faces in each are of the same number as the sides of the bases.
*T.* What kind of side faces are these?
*Ch.* They are triangular side faces.
*T.* Show me the base of each triangle.
*Ch.* The base of each triangular side face forms one side of the base of the solid. (Class decision. T. confirm.)



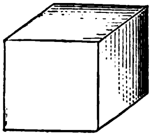
*T.* Show me the apex of each triangular side face.
*Ch.* They all have the same apex or point where they meet. (Class decision. T. confirm.)
*T.* Thinking of what you have learned, describe this solid.
*Ch.* That solid has one plain polygonal base and as many triangular side faces as the base has sides, all meeting at one point called the apex.
*T.* Find other solids of which this is true. (Children find or mould several, and describe each.)
*T.* For what are we now ready?
*Ch.* We are ready for the definition and the name.
*T.* Who can make the definition?
*Ch.* A solid that has one plane polygonal base, and as many triangular side faces as the base has sides, all meeting at one point called the apex, is called (Ch. or T. give term) a *pyramid.* (Simultaneous recitation. T. write on board.)

NOTE.—T. may teach here the difference between right and oblique cones and pyramids.

*T.* (Presenting a cube.) What is this?
*Ch.* It is a solid.

*T.* Describe it, thinking of the way in which it is bounded.

*Ch.* It has six plane faces.



*T.* Compare those faces with each other in regard to size, and state what you observe.

*Ch.* The faces are equal. (Class decision. T. confirm.)

*T.* What is the form of these faces?

*Ch.* They are square faces.

*T.* Describe this solid, thinking of what you have learned.

*Ch.* That solid has six equal square faces.

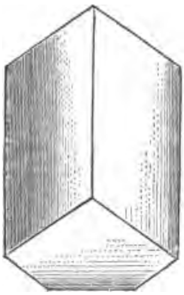
*T.* What is it called?

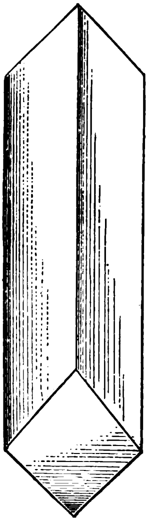
*Ch.* A solid that has six equal square faces is called (Ch. or T. give term) a *cube.* (Simultaneous recitation. T. write on board. Have Ch. mould other cubes.)

*T.* (Presenting prism.) Look at this solid, and state what you observe in regard to its bases.

*Ch.* It has two equal, plane, parallel polygonal bases. (Class decision. T. confirm.)

NOTE.—If the previous work has been carefully done, the children will have no difficulty in making this statement in regard to the bases.





*T.* You may speak of the side faces.

*Ch.* It has several side faces.

*T.* How does the number of side faces compare with number of sides of each base?

*Ch.* The side faces are as many as the sides of each base.

*T.* What is the form of the side faces?

*Ch.* They are parallelograms. (Class decision. T. confirm.)

*T.* Describe this solid in regard to what you have learned.

*Ch.* That solid has two equal plane parallel polygonal bases, and as many parallelogram side faces as each base has sides.

*T.* Find other solids of which this is true. (Children find several, mould others, and describe until familiar with the words.)

*T.* Who can make the definition?

*Ch.* A solid that has two equal plane polygonal bases, and as many parallelogram side faces as each base has sides, is called (Ch. or T. give term) a *prism.*

Drill by having child find and describe different solids; by having them mould; and by having them read definitions on the board. Then erase work, remove objects, and have children recall what they have learned.

NOTE. — T. may here lead pupils to see that a *cube* is one kind of a prism, and that a prism whose bases are parallelograms is called a *parallelopipedon.*

With small children, I would advise that the teacher do not trouble them with the definitions of solids for some time; but, with more advanced pupils, a great deal of good will result from describing and constructing definitions based upon the descriptions.

# LESSONS ON PLACE.

## LESSON I.

PATTERNING.

**OBJECT.**

To cultivate *Perception*, *Conception*, *Comparison*, *Judgment*, *Memory*, and *Language*.

**POINT.**

To develop idea of *Position, by imitating what the Teacher does.*

**MATERIALS.**

Table inclined towards the class, to enable each child to see the patterns placed on it. Papers cut in different forms, — squares, triangles, circles, etc. At first these papers should be large, and such as will form simple designs. In the first lesson, not more than three papers should be used in any one design, and not more than three different designs should be made by the teacher. Each child must have as many papers as the teacher uses. If he has more, there will be greater room for the exercise of comparison and judgment.

**METHOD.**

*Teacher.* (Presenting papers.) What have I?

*Child.* You have some cards.

*T.* How many cards have I in my hand?

*Ch.* You have three.

*T.* Observe carefully what I do with these cards. (Arranges them in a simple design on the table.) What have I done?

*Ch.* You have laid the cards on the table.

*T.* Where have I placed them in regard to each other?

*Ch.* You have placed them near each other (or close to each other). (Class decision. T. confirm.)

*T.* You may each find among your cards three cards just like these three I have used. (Children find them, stating: These cards are just like yours.)

*T.* Now you may place them on your desks, and make something just like this that I have made. (If the children have no desks, the T. may have three or four go to the table and make patterns there, the other children watching and describing what has been done. It is much better, however, for all the children to work at the same time, as children, as well as grown people, appreciate what they *do* with their own hands, much more than what they *see* done.)

*T.* What have you done, Mary?

*Ch.* I have placed three cards together, and made something just like what you made.

*T.* How many think that Mary has made something like this which I have made? (Children examine closely and decide. T. confirms.)

*T.* What have you done, John?

*Ch.* I have placed three cards on the desk, and made something just like that which you made.

*T.* James, you may tell what John has done.

*Ch.* John has made something like that which you made.

*T.* Jane and Susan may tell what they have made.

*Children.* We have made something like that which you have made.

*T.* (After examining each desk to see that no mistakes have been made.) You may all tell me what you have done.

*Class.* We have made something just like that which you made.

*T.* (Presenting other papers.) What have I now?

*Ch.* You have three other cards.

*T.* Compare them with the first cards I used, and tell me what you observe.

*Ch.* They are not the same shape as those you first used. (Class decision. T. confirm.)

*T.* What other difference do you observe?

*Ch.* They are smaller than those you first used.

*T.* Observe what I do. (Makes a new design.) What have I done?

*Ch.* You have placed those three cards together, and made something else (another figure).

*T.* Compare the figure I have just made with the one I first made, and tell me what you observe.

*Ch.* The figure you have just made is smaller than the one you first made. (Class decision. T. confirm.)

*T.* Mention any other difference you observe.

*Ch.* It is not the same shape as the first. (Class decision. T. confirm.)

*T.* Each child may find three cards just like those I used in making the second figure, and make a figure like this. (Children do so, each stating what he has done, as in the previous work. Care

should be taken here that the children speak distinctly, and describe accurately, using full statements every time they speak. If the work is properly done, there is little danger that the children will tire of talking. Children love to tell what they know.)

*T.* (Presenting other papers, no two of which are alike.) What have I now?

*Ch.* You have three more cards.

*T.* Compare them with those I have already used, and tell me what you observe.

*Ch.* They are smaller than any you have used. (If they should be larger, or of the same size, of course the children will state the difference or resemblance, as the case may be.)

*T.* What other difference do you observe?

*Ch.* They are not shaped like any of the cards you have used. (Class decision. T. confirm.)

*T.* Compare these cards with each other in regard to size, and tell me what is true of them.

*Ch.* They are not of the same size; or, they are of different sizes.

*T.* Compare them with each other in regard to shape, and state what you observe.

*Ch.* They are of different shapes. (Class decision. T. confirm.)

*T.* Now observe what I do. (Makes new design.) What have I done?

*Ch.* You have placed them together and made another figure.

*T.* You may each find three cards like these I used last, and make a figure like this which I have made. (Children have, perhaps, some difficulty in selecting three cards of different forms, but at length get them, and make the design, several stating accurately and fully what they have done.)

*T.* (Disarranging the designs and mixing the cards used.) What have I done now?

*Ch.* You have put all the cards together. (Children do so.)

*T.* Now you may each select the three cards you first used, and make the first figure I made. (Children do so perhaps with some difficulty. Perhaps some can not remember the design, in which case they may look at the work of those who have been successful in recalling the work done. After the first, the T. may give directions to have the second and third reproduced.)

Note. — The work in patterning from sight and memory may last a week, and to keep up the interest, other objects than paper may be used. Blocks and boxes make a pleasant variety, and may be used. After the first day or two the T. may appoint some bright pupil to make the designs at the table, and have the other children imitate his work.

## LESSON II.

### Position Words.

**OBJECT.**

To cultivate *Perception, Conception, Comparison, Judgment, Memory,* and *Language.*

**POINT.**

To develop idea of, and teach words in, *On, Under, Over, Above, Below, Across, Round, Behind, Against, Beside, By,* etc.

**MATTER.**

The ball is in the cup.
The ball is on the table.
The ball is under the cup.
The cup is over the ball.
The block is above the cup.
The cup is below the block.
The string is across the book.
The string is round the ball.
The child is behind the door.
The chair is against the door.
The book is beside the box.
The marble is by the ball.

**METHOD.**

The T. may open the lesson with a short conversation about the different articles on the table, getting from the children the names of each, after which the work may begin.

*Teacher.* Watch me now and see what I do. (Placing the ball in the cup.) What did I do?

*Child.* You put the ball in the cup. (T. write on board word *in*, call attention to it, and drill.)

*T.* Where is the ball, Jane?

*Ch.* The ball is in the cup.

*T.* (Placing the ball on the table.) Where is the ball now?

*Ch.* The ball is on the table. (T. write on board word *on*, and drill.)

*T.* (Turning the cup over the ball.) Where is the ball now?

*Ch.* The ball is under the cup. (T. write on board word *under*, and drill.)

*T.* Where is the ball, thinking of the table?

*Ch.* The ball is on the table.

*T.* Where is the cup, thinking of the table?
*Ch.* The cup is on the table.
*T.* Where is the cup, thinking of the ball?
*Ch.* The cup is over the ball. (T. write on board word *over*, and drill.)
*T.* (Presenting a block.) What is this?
*Ch.* It is a block.
*T.* (Holding the block.) Where is the block?
*Ch.* It is in your hand.
*T.* (Placing it on the table.) Where is it now?
*Ch.* It is on the table.
*T.* (Placing it under a book.) Where is it now?
*Ch.* It is under the book.
*T.* Where is the book, thinking of the block?
*Ch.* The book is over the block.
*T.* (Holding the block above the cup.) Where is the block now, thinking of the cup?
*Ch.* The block is above the cup. (T. write on board word *above*, and drill. It is possible that a child may say the block is over the cup, in which case the T. will lead him to see that the word *over* implies covering, while *above* does not.)
*T.* Where is the cup in regard to the block?
*Ch.* The cup is below the block. (T. write on board word *below*, and drill. If child should say the cup is *under* the block, T. leads him to see that *under* implies covered.)
*T.* You may place something over something, and state what you have done.
*Ch.* (Placing open box over the block.) I have put the box over the block. (Drill on these words in various ways, until children fully appreciate their use.)
*T.* (Presenting string.) What have I?
*Ch.* You have a string.
*T.* Where is the string?
*Ch.* It is in your hand.
*T.* (Placing it on table.) Where is it now?
*Ch.* It is on the table.
*T.* Where is it now?
*Ch.* It is above the table.
*T.* Where is it now?
*Ch.* It is below the ball.
*T.* (Laying it across the book.) Where is it now?
*Ch.* It is on the book.
*T.* How is it on the book, thinking of the direction?
*Ch.* It is across the book. (T. write on board word *across*, and drill.)

*T.* You may place the string across something, and state what you have done.

*Ch.* (Placing string across the box.) I have put the string across the box.

*T.* Where is the string?

*Ch.* It is across the box.

*T.* Mary, what did John do?

*Ch.* He put the string across the book.

*T.* Watch closely and see what I do. (Placing string round the ball.) Where is the string now?

*Ch.* It is on the ball.

*T.* Where on the ball is it?

*Ch.* It is round the ball. (T. write on board word *round*, and drill.)

*T.* You may do as I did, just now, with the string.

*Ch.* (Placing string round a bottle.) I have put the string round the bottle.

*T.* John, what did Mary do?

*Ch.* Mary put the string round the bottle.

*T.* Now, watch closely and see what I do. (Placing a little girl behind the door.) Where is Mary?

*Ch.* She is behind the door. (T. write on board word *behind;* drill as with the words *across*, *over*, *under*, etc.)

*T.* Watch and see what I do this time. (Placing a chair so that it touches the door.) Where is the chair?

*Ch.* The chair is against the door. (T. write word *against*, and drill. Possibly the children may say the chair is near the door, or close to the door, in which case the teacher will lead them to see that she cannot open the door without moving the chair, as the chair is *against* the door.)

*T.* Now observe what I do. (Placing the book beside the box.) Where is the book, thinking of the box?

*Ch.* The book is close to the box.

*T.* Tell me that in another way.

*Ch.* The book is near the box.

*T.* That is true, but tell me in another way.

*Ch.* The book is beside the box. (T. write on board word *beside*, and drill as before.)

*T.* Where is the marble, thinking of the ball?

*Ch.* The marble is beside the ball, or *by* the ball. (T. write on board word *by*.)

Drill by having children replace objects in the positions indicated by the position words on the board, and by having them recall objects in their homes that are in certain positions.

NOTE. — The work upon position words will occupy at least a week, as it will not be possible for little children to learn to use more than two or three new words in each lesson. Encourage the children to talk as much as possible, but do not let them wander from the point of the lesson. With a little care the T. can help them form a habit of concentration that will be of great value in later work, and indeed throughout their lives.

## LESSON III.

### Right and Left.

**OBJECT.**

To cultivate *Perception*, *Conception*, *Comparison*, *Judgment*, *Memory*, and *Language*.

**POINT.**

To develop idea of, and teach terms, *Right* and *Left*.

**METHOD.**

*Teacher*. John, you may bring me a book. (Ch. does so.)
*T*. With what did John bring me the book?
*Child*. He brought you the book with his hand.
*T*. John, show the hand with which you brought it.
*Ch*. (Presenting hand.) I brought the book with this hand.
*T*. Mary may toss this ball. (Ch. does so.)
*T*. Show the hand with which you tossed the ball.
*Ch*. I tossed the ball with this hand.
*T*. James, you may take this knife and stick, and whittle. (Ch. does so.)
*T*. Show the hand which holds the knife.
*Ch*. This hand holds the knife.
*T*. Susan may shake hands with Mary. (Children do so.)
*T*. Each child may show the hand she used just now.
*Ch*. I used this hand.
*Ch*. I used this hand.
*T*. Bring me a book, John, and do not use the hand you used before. (Ch. does so.) You may show the hand with which you brought the book.
*Ch*. I brought the book with this hand.
*T*. How many hands have you?
*Ch*. I have two hands. (Class decision. T. confirm.)
*T*. Raise your hand, James. (Ch. does so.)
*T*. That is not the hand I wished you to raise. Why did you not raise the one I wanted?
*Ch*. I did not know which one you wanted me to raise.
*T*. What can I do to make you know which hand I wish you to raise?
*Ch*. You can say which hand you mean.
*T*. What shall I say that will tell which hand I mean?
*Ch*. You can say the name of the hand.

*T.* Very well. Who knows the name of the hand which James raised? (Children may not know.)

*T.* It is called the *right* hand. (Simultaneous recitation. T. write on board word *right*.)

*T.* Each child hold up the right hand. (Children do so, stating: This is my right hand.)

*T.* You may mention things that you do with the right hand.

*Ch.* I write with my right hand.

*Ch.* I hold the knife with my right hand.

*Ch.* I shake hands with my right hand.

*T.* Hold up the other hand. (Children do so.)

*T.* Who knows the name of this hand?

*Ch.* (or *T.*) This is called the *left* hand.

*T.* All show their left hands. (Children do so, stating: This is my left hand.)

*T.* Show me your right eye.

*Ch.* (Touching.) This is my right eye.

*T.* Show me your right ear.

*Ch.* (Touching.) This is my right ear. (This work of right and left parts of the body should be carried on until the children can name them rapidly.)

*T.* You may point to the right.
Look to the right.
Throw a ball to the right.
Walk to the right.
Name a house to the right of this.
Name a tree to the right of this. (T. have similar work for *left*, until the children can use the terms intelligently and readily.)

*T.* Go to the table, and find parts of top. (Children find sides and ends.)

*T.* Find the right end of the table.

*Ch.* (Touching.) This is the right end of the table.

*T.* Find left end.

*Ch.* This is the left end.

*T.* (Touching front.) What shall we call this part of the table?

*Ch.* This is the front of the table.

*T.* (To back.) What is this called?

*Ch.* That is the back of the table.

*T.* (To corner.) What is this?

*Ch.* That is a corner.

*T.* How many corners has the top of the table?

*Ch.* It has four corners.

*T.* (To right front corner.) What corner is this?

*Ch.* It is the right front corner.

*T.* (To left front corner.) What corner is this?

*Ch.* This is the left front corner.

*T.* Find and name the other corners.

*Ch.* This is the right back corner. This is the left back corner.

*T.* (Placing various objects upon different parts of the table.) Where is the book?

*Ch.* It is on the right end of the table.

*Ch.* The ball is on the right back corner of the table.

*Ch.* The cup is on the left front corner of the table. (This work may be continued until the children can describe positions readily.)

*T.* Now we shall look at the top of the table again. (Removes objects.) Compare the front of the table with the right end, and tell me what is true of their length.

*Ch.* The front of the table is longer than the right end. (Class decision. T. confirm. Ch. had better measure before deciding.)

*T.* Compare the front with the back, thinking of their length, and tell me what is true.

*Ch.* The front and back of the table are of the same length. (Class decision. Measuring. T. confirm.)

*T.* Compare the right end with the left end, thinking of their length, and tell me what is true.

*Ch.* The right end and left end are of the same length. (Class decision. Measuring. T. confirm.)

*T.* (Presenting slate.) I wish you to make a picture of the table on this slate. Now, where shall we place it?

*Ch.* We might place it on the table.

*T.* In what position shall we put it?

*Ch.* We must put it so that the ends of the slate point to the ends of the table. (Class decision. T. confirm.)

*T.* Now find the parts of the slate as you found the parts of the top of the table.

*Ch.* This is the front of the slate.

*Ch.* This is the back of the slate.

*Ch.* This is the right end.

*Ch.* This is the left end.

*Ch.* This is the right front corner.

*Ch.* This is the left front corner.

*Ch.* This is the right back corner.

*Ch.* This is the left back corner.

*T.* Now we shall make a picture of the back of the table first. What shall we use to make this picture?

*Ch.* We shall use a line.

*T.* What kind of a line must it be?

*Ch.* It must be a straight line.

*T.* Where on the slate shall we draw it?

*Ch.* We shall draw it along the back of the slate.

*T.* You may do so, and state what you have done.

*Ch.* (Drawing the line.) I have made a picture of the back of the table.

*T.* What part shall we draw next?

*Ch.* We may draw the picture of the right end of the table.

*T.* You may do so, and state what you have done.

*Ch.* (Drawing the right end line.) I have made a picture of the right end of the table.

*T.* What shall we draw next?

*Ch.* We shall draw the left end next.

*T.* You may do so.

*Ch.* (Drawing left end line.) I have made a picture of the left end of the table.

*T.* What have we left to draw?

*Ch.* We have the front left to draw.

*T.* You may draw that part.

*Ch.* (Drawing front line.) I have made a picture of the front of the table.

*T.* What have we now on the slate?

*Ch.* We have a picture of the top of the table on the slate.

*T.* (Pointing to right end line.) Find the part of the table of which this is a picture. (Ch. finds the part, stating what he has found. T. may drill in this way until the children fully understand. The T. will then place objects on different parts of the table, have children describe their positions, and have other children represent them in corresponding positions in the picture; have others describe positions of objects on the table and in the picture.)

NOTE. — The work upon right and left will take a week.

## LESSON IV.

### Points of the Compass.

With young children this part of the study of Place belongs to the second year's work, as it is more difficult than the previous part.

**OBJECT.**

To cultivate *Perception*, *Conception*, *Comparison*, *Judgment*, *Memory*, and *Language*.

**POINT.**

To develop idea of, and teach, *East*, *West*, *North*, *South*.

**MATTER.**

1. *Where the sun rises is East.*
2. *Where the sun sets is West.*
3. *Standing with the right hand pointing towards the East, and the left hand towards the West, the North is directly before us, and the South directly behind us.*

Note. — Before beginning to develop ideas of cardinal points, the T. should lead the children to perceive that Right and Left are relative terms, and to appreciate the necessity for cardinal points.

**METHOD.**

Teacher reviews *Right* and *Left* hands, parts of the body, *Right* and *Left* hand sides of the room, of the street, etc.

*Teacher.* Mary, you may go to the table and find the right and left sides.

*Child.* This is the right side; this is the left side.

*T.* (Changing child's position.) Now find the right and left sides.

*Ch.* This (towards right hand) is the right side, and this (towards the left hand) is the left side.

*T.* What did Mary do?

*Ch.* She moved from one place to another (or she changed her position).

*T.* What have you observed in regard to the right side which she found first, and the one she has just now found?

*Ch.* The right side she first found is not the same as the right side she has just now found. (Class decision. T. confirm.)

*T.* Why is it not the same?

*Ch.* She changed places, and that made it different.

*T.* John may face to the window, and point to the right side of the room.

*Ch.* (Does so, pointing.) This is the right side of the room.

*T.* Now turn round and point to the right side. (Ch. does so, stating. After several trials, T. leads the children to the conclusion that right and left change as we change our positions. Do not have small children state that *Right* and *Left* are *relative* terms, as they cannot yet appreciate the word *relative.*)

*T.* (Arranging several children in different positions on the floor.) I wish you to bring me those articles from the table at my right. Each of you may walk to the right and bring them to me. (Children each walk to the right, and do not reach the table.)

*T.* Why did you not reach it?

*Ch.* Right was different with each of us, and we went in different directions. (T. try the same with *left*, with the same results.)

*T.* Suppose I were to send you for a book in the next room, and were to tell you that it lies in the right hand corner, how many would know where to go to look for it?

*Ch.* We should not know, as we would not know in what position we must stand to have that corner on our right. (Class decision. T. confirm.)

*T.* What could I say that would tell you, at once, in what part of the room to look?

*Ch.* You could tell us a name for that part of the room. (Class decision. T. confirm. Leading children to perceive that certain absolute terms known to all must be used before they could have a correct idea of the positions of objects they could not see.)

*T.* This morning I rose very early, and almost the first thing I did was to light my lamp. Why do you suppose I did that?

*Ch.* Because it was dark. You could not see without it.

*T.* Yes, that was the reason. Well, I read a while by the lamp, and then found that I could see without it. Why do you think I could see without it?

*Ch.* It was daylight.

*T.* Yes, it was; and when I looked at my window, I saw a light much brighter than any lamp. What do you think it was?

*Ch.* The sun was rising, and shone in your window.

*T.* Yes, that was just what it was. How many have seen the sun rise? (Some have.)

*T.* Point towards the place where the sun rises. (Children point.)

*T.* Walk towards the place where the sun rises. (Children walk.)

*T.* Who knows what the place where the sun rises is called?

*Ch.* (or *T.*) Where the sun rises is called the *East.* (Simultaneous recitation. T. write on board statement.)

*T.* Point towards the east.
Walk towards the east.
Point to the east side of the room.
Point to the east side of the street.
Face towards the east.

*T.* Where is the sun now? (Children state.)

*T.* Where else have you seen the sun? (Children point and state.)

*T.* What do we call that part of the twenty-four hours during which we see the sun?

*Ch.* We call it the daytime.

*T.* Why can we not see the sun at night?

*Ch.* Because the sun sets (or goes down) at night.

*T.* Point towards the place where the sun sets. (Children do so.)

*T.* Walk towards the place where the sun sets. (Children do so.)

*T.* Who knows what that place is called?

*Ch.* (or *T.*) Where the sun sets is called the *West.* (Simultaneous recitation. T. write on board full statement.)

*T.* Point towards the west.
Walk towards the west.
Find west side of room.
Find west side of hall.
Find west side of playground.
Point towards east and west at the same time.

*Ch.* My right hand is pointing towards the east, and my left hand is pointing towards the west.

*T.* All stand in that position.

*T.* Standing with the right hand pointing towards the east, and the left hand towards the west, what is directly before us?

*Ch.* (or T.) The *North* is directly before us.

*T.* What is behind us?

*Ch.* (or T.) The *South* is behind us.

*T.* Who can name the points we have learned?

*Ch.* We have learned *East, West, North,* and *South.*

*T.* Describe the positions of those points.

*Ch.* Where the sun rises is east. Where the sun sets is west. Standing with the right hand pointing towards the east, and the left hand pointing towards the west, the north is directly before us, and the south is directly behind us. (Simultaneous recitation. T. write on board last statement.)

Drill on cardinal points applying to inside of school-room, then to the school-yard, then to the block (if in the city), to fields (if in the country).

Have children tell what street is north of the block, where school-house is situated, what street is east, south, and west. This gives the idea of boundaries. Apply terms until children use them readily and intelligently, then teach the semi-cardinal points, *North-east*, *South-east*, *North-west*, *South-west*. This can be done by having children point one hand east, the other north. North-east lies between the two, but do not teach that it lies just half way between, as children will get a wrong idea. Similar work for other semi-cardinal points. The work that *Right* and *Left* are relative terms, the necessity for absolute terms, the cardinal and semi-cardinal points, will take at least four weeks.

## LESSON V.

### Plan for Map Drawing, Moulding, and Use of Maps.

1. Review previous work thoroughly.
2. Lay slate on table, and draw on it a map of the top of table, using terms *North*, *East*, *South*, and *West*, and semi-cardinal points as well, when necessary.
3. Hold slate in a vertical position, and apply terms as before.
4. Transfer picture of top of the table to the board on north side of the room, and apply terms as before.
5. Have child state: The line representing north side of the table is placed at the top (North).

   The line representing east end of the table is placed at the right hand (East).

   The line representing west side of the table is placed at the left hand (West).

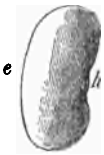
   The line representing the south side of the table is placed at the bottom (South).
6. Children may use the term *map*, and may state: The top of this map is *North*.

   The right-hand side is *East*.
   The left-hand side is *West*.
   The bottom is *South*.
7. May now lead children to see that a picture of an object may be longer or smaller than the object, and yet be a true picture so long as it has the same form or shape. This prepares the way for teaching children to draw to a scale.
8. If children have not had size lessons, the teacher will develop idea of, and teach, *yard*, *foot*, *inch*. This may be done by dividing the yard into three equal parts, or three feet. Then divide the foot into twelve equal parts, and take one of these equal parts for an inch.
9. Children may now measure the floor of school-room, and draw a map of it on the board on north side of the room, representing the north side of the room by the top line, east side by right-hand line, west side by left-hand line, and south side by the bottom line. Drill on these.
10. As it will be impossible to draw the floor the full size on the board, the children must be taught that they may draw one inch to represent one foot, or to represent three feet, as the case may be.
11. Any break in the straight line of the side of the room may be shown by a similar break in straight line of the map, representing that side.

12. The position of desks or other objects must be indicated in the map.
13. The work of moulding in sand or clay may be begun now, and conducted in much the same way as map-drawing.
14. The sand should be placed on a smooth board with a rim not more than one inch high. Let the sand be moist, but not too wet.
15. The scale to which the moulding is made may or may not be the same as that to which the map is drawn. At first, it will be well to have it the same. If it were possible, it would be well for each child to have a small moulding-board, as it is rather trying to the little ones to watch the work and have no hand in it.
16. After a map of the school-room floor is drawn, a map of the yard may be made, and a moulding as well.
17. After a map of the yard, a map and moulding of a block may be made in exactly the same way, allowing one inch or half an inch for so many feet, or so many yards, as the case may be.
18. Children bound the block by streets on north, east, south, and west. (Blocks are also bounded by other blocks.)
19. They may now mould and draw the block north of the first, the block east, and the block west.
20. They may now mould and draw the outline of the whole city (using city map for reference).
21. After the work upon the town or city, the study of the county map may begin.
22. The county is composed of townships. Take first the township in which children live, and go from this to those nearest, and then to the more remote. Draw and mould as the map is studied.
23. Physical features, waters, elevations, etc., may be first taught incidentally in the study of the city, and continued in the study of the townships and county.

ILLUSTRATIONS TO LESSONS ON PLANTS.

I.

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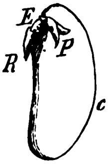


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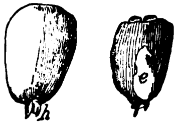


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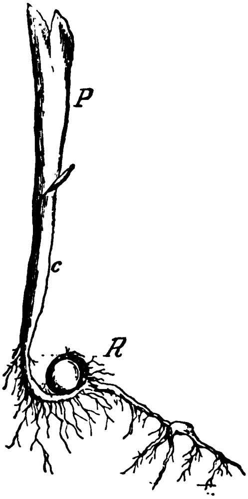



IV.


DICOTYLEDONOUS SEED.

I. *h* Hilum.
*e* Seed-coat.
*c* Cotyledon.

II. *E* Embryo.
*P* Plumule.
*R* Radicle.

III. MONOCOTYLEDONOUS SEED.
*h* Hilum.
*e* Embryo.

IV. Bean showing plumule (*P*) between cotyledons (*ec*).

V. Bean further advanced.

VI. Indian corn with roots growing.
*P* Plumule.
*c* Cotyledon.
*R* Radicle.

# LESSONS ON PLANTS.

## INTRODUCTION.

In this work I have thought it unnecessary to indicate at the beginning of each lesson the points to be developed, and the matter to be taught. I have also considered it unnecessary to continüe the method of question and answer beyond three topics, as it will be much better for the teacher to arrange his own matter, and, as far as possible, to originate his own plans and methods of instruction. By referring to the summary upon each topic, he will perceive the order in which the matter should be taught.

Limited space has prevented my doing more than suggest the work to be done. The teacher will need for reference, Gray's "Common School Botany," "How Plants Grow," "How Plants Behave." Miss Eliza Youman's First and Second Books of Botany are also very valuable for reference. None of these books should be put into the hands of the children, and *no lessons in Botany should be learned by heart.*

Technical terms should not be taught until the pupils need them, and carefully appreciate their significance.

The object of the work is to bring the child in contact with nature; to teach him to observe, think, reason, and to express himself naturally. If memorized lessons are recited, the work becomes formal, and the effect is destroyed.

In regard to specimens, it is not necessary to say that one can hardly have too many. The most familiar plants should be used first. They can be obtained in any field or garden.

If there is sufficient ground around the school-house, the pupils should be encouraged to plant seeds, and to cultivate many of the plants to be studied in class.

The work in writing and drawing should be carried on in connection with this subject, in the same way as in the study of insects. A scrap-book, for items upon Botany, should be kept, and out-door observation should be recorded.

Before beginning the work upon Seeds, it may be well to have a few conversational lessons upon plants in general. The pupils may be led to distinguish herbs, shrubs, and trees. They may also be taught the general uses of plants, and the sources from which they derive their food. The trees of the garden may be distinguished from the trees of the forests; evergreen trees from deciduous trees, etc.

## LESSON I.

### The Seed.

*Teacher.* (Presenting seeds of different kinds, — bean, Indian corn, pea, apple, pumpkin, wheat, rice, oats, sunflower, etc.) What are these?

*Child.* They are beans, peas, rice.

*T.* That is true, but you may tell me what one name will apply to all.

*Ch.* They are seeds.

*T.* You may name as many of these seeds as you know. (Children probably know all by name.)

*T.* You may each take the bean seed in your hand. You may describe it in regard to size.

*Ch.* (Measuring.) It is nearly one inch long.

*Ch.* It is about half an inch wide.

*Ch.* It is about one-quarter of an inch thick.

*T.* Describe the shape.

*Ch.* It has two sides curved somewhat, and it has curved edges.

*T.* Describe it still further.

*Ch.* It is smooth.

*Ch.* It is shiny.

*Ch.* It is hard.

*Ch.* It is white.

*T.* Compare the color of the seed with the color of this paper, and tell me what you observe.

*Ch.* The seed is somewhat yellowish, and the paper is pure white.

*T.* Who can describe the color accurately?

*Ch.* It is creamy white. (If possible, the T. should have the beans all of the same color at first; later, the pupils may examine those of different colors and sizes, and may be led to state that beans are of different sizes and colors.)

*T.* You may mention anything else you observe about this seed.

*Ch.* I have found a little place on the inner edge something like an eye.

*T.* Describe it more carefully.

*Ch.* It is darker in color than the other part of the seed.

*Ch.* It is like a scar.

*T.* It *is* like a scar. Who can think how it was made?

*Ch.* It is the place where the bean was fastened to the pod. (If pupils do not perceive this, the T. will show them pods with beans attached.)

*T.* This place is called the *hilum* or scar. (Simultaneous recitation. T. write on board word *hilum*.)

*T.* (Presenting beans that have been soaked in water for some time.) Compare this bean with those you have been looking at, and state any differences you observe.

*Ch.* This seed is softer than the first one you gave us.

*Ch.* The outside part of this bean is ruffled, and the first one is quite smooth.

*T.* You may remove the outside part. Do so very carefully, so as not to break it. (Children use knives or needles in removing coats.)

*T.* What have you removed?

*Ch.* I have removed an outside covering, or case.

*T.* Think of another name by which you may call it.

*Ch.* It is like a skin.

*Ch.* It is like a coat.

*T.* Yes, it is called the seed-coat. Now you may describe it very carefully.

*Ch.* The seed-coat is soft.

*Ch.* It is smooth.

*Ch.* It is thin.

*Ch.* It is something like leather.

*Ch.* It is rather tough.

*Ch.* It is white.

*T.* Hold it up to the light, and state what you observe.

*Ch.* I can see light through it, but I cannot see objects. (Class decision. T. confirm, and give the term *translucent.*)

*T.* Of what use is the seed-coat?

*Ch.* It protects the other part of the seed.

*T.* From what does it protect the rest of the seed?

*Ch.* It protects it from the air, and from moisture. (Class decision. T. confirm.)

*T.* Now examine the part that was left after removing the seed-coat, and state what you observe.

*Ch.* It is smooth, and quite hard.

*Ch.* It is of a yellowish white.

*Ch.* It cuts like cheese.

*T.* What else do you observe?

*Ch.* It has two parts.

*T.* Describe those parts.

*Ch.* Each one has a flat side and a curved side.

*Ch.* The two flat sides fit closely together.

*T.* The part of the seed which is left after removing the seed-coat, is called the body, or *kernel* of the seed. (Simultaneous recitation. T. write on board word *kernel.*)

*T.* You may describe the parts of the kernel further.

*Ch.* The parts of the kernel look something like two leaves.

*T.* Each of these is called a *cotyledon*, or seed-leaf. (Simultaneous recitation. T. write on board word *cotyledon*.)

*T.* How many cotyledons has the bean seed?

*Ch.* The bean seed has two cotyledons.

*T.* Because it has two cotyledons it is said to be *dicotyledonous*. (Simultaneous recitation. T. write on board word *dicotyledonous*.)

*T.* Now examine these other seeds (presenting one of each kind), and find as many dicotyledonous seeds as you can. (Children examine, and, after some time, state that the pea, apple, pumpkin, and sunflower seeds are dicotyledonous, but that the Indian corn, wheat, oats, etc., are not so. (T. may here explain that they have only one cotyledon, or seed-leaf, and hence are called *monocotyledonous*, *monos*, Gr., meaning *one*.)

*T.* (Presenting beans that have germinated.) Examine the kernels of these seeds very carefully, and describe what you find.

*Ch.* I have found something between the cotyledons.

*T.* Describe the position more accurately.

*Ch.* It is at one end of the kernel just where the edges of the cotyledons meet.

*Ch.* It is made up of two parts.

*Ch.* One part points towards the edges of the cotyledons, and the other part points up between the flat sides of the cotyledons.

*T.* Who can think what this may be?

*Ch.* It is the part from which the bean plant grows. (Class decision. T. confirm.)

*T.* That is true, and it is called the *embryo* or the beginning of the plant. (Simultaneous recitation. T. write on board word *embryo*.)

*T.* You may describe the embryo very carefully.

*Ch.* The embryo is made up of two parts.

*Ch.* The part which points to the outside of the cotyledons is very small. It is slender, round, and white.

*Ch.* The other part seems to have two little things at the end. (If the pupils have lenses, they will have no difficulty in seeing the two little leaves.)

*T.* What do you think those two little things may be?

*Ch.* They may be little leaves. (Class decision. T. confirm.)

*T.* You have told me that the embryo will become a plant, and that it has two parts. How many parts has a plant?

*Ch.* It has two parts.

*T.* You may describe those parts, thinking of their position when growing.

*Ch.* One part grows in the ground, and the other grows up from the

ground. (It would be well to have a whole plant, to show the pupils each part.)

*T.* Now, to which of these parts does the part of the embryo which you first described correspond?

*Ch.* It corresponds to the part which grows in the ground.

*T.* Yes, it is the part from which the root grows, and it is called the *radicle.* (Simultaneous recitation. T. write on board word *radicle.*)

*T.* Now, what is this other part of the embryo?

*Ch.* It is the part which grows above the ground, or the stem.

*T.* Yes, it is the part from which the stem grows, and it is called the *plumule.* (Simultaneous recitation. T. write on board word *plumule.* Children will be very apt to state that the whole plant grows above the ground, and the teacher will have to show them several times that the root is a part of the plant.)

(The teacher will now present other seeds that have germinated, and let pupils find the embryo in each. Let them state that the plumule of a dicotyledonous seed has two little leaves, while that of a monocotyledonous seed has but one leaf. Let them state that when the leaves first appear above ground there are two leaves from a dicotyledonous seed, and one from a monocotyledonous seed.

They may compare the different seeds as to size, form, surface, color, number of parts, seed-coats, embryos, etc.

The comparative work upon the seed-coats will be very interesting as there are hardly two having the same texture.)

*T.* Who can think of what use the cotyledons are to the bean? (Perhaps the pupils cannot answer this question. If not, the teacher will lead them to see that they provide nourishment for the little plant until it grows strong enough to take its food from the soil and the air. Also lead them to examine the corn, and find that though it has but one cotyledon, it has sufficient nourishment for the little plant in the albumen in which the embryo is embedded. Teach that because of the presence of albumen the seeds of the Indian corn, and indeed of all monocotyledonous seeds, are said to be *albuminous,* while the dicotyledonous seeds are said to be *exalbuminous.*)

*T.* Now, you may tell me what these seeds need in order to begin to grow (germinate).

*Ch.* They need warmth.

*Ch.* They need moisture.

*Ch.* They need air. (T. may here show children that the seed will germinate in water as well as in the earth, and in the light as well as in darkness.)

*T.* Of what use are seeds?

*Ch.* They produce new plants.

*Ch.* They are used for food.

*Ch.* They are used for medicines.

*Ch.* They are used for distilling.

*Ch.* They are used for making oil.

*Ch.* They are used for fertilizers.

*Ch.* They are used for fuel in some States. (Probably the children will not think of all these uses. If not, the teacher will lead them to make the statements. The last use refers to the use of corn in some Western States.)

(The work on the seed ought to occupy two or three, or perhaps more, days. At the beginning of the work, the teacher will have each child plant a seed in boxes in the windows, or, if there is ground outside, near the school-house. If pupils are old enough, have each child keep a written record of the growth and appearance of his plant.

In this book he will first enter the name of his seed, the date of planting, the date of its appearing above ground, whether the seed came above ground or remained at the root, when the first leaves grew on the stem, etc.

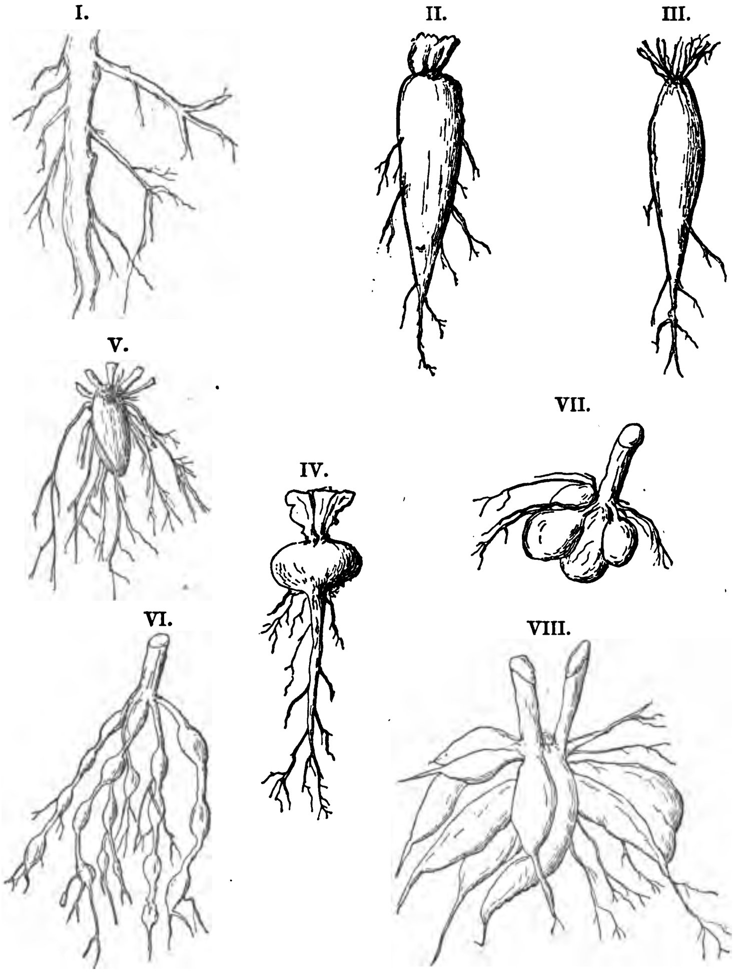
If the pupils are very small, it will be well for the teacher to keep a record of facts concerning the seed which the little ones shall discover. In this case, to save work and trouble, it will be well to have all the pupils plant the same seed.

As work out of school hours, the teacher may assign certain seeds to be examined and carefully described. These descriptions must be in writing, as well as those which are made in class. After examining a seed, a careful drawing must be made, showing the seed as a whole, and the different parts. Every lesson of observation should be followed by a writing, reading, and drawing lesson upon the same subject.)

## SUMMARY OF WORK UPON SEEDS.

### *The Seed.*

- I. PARTS . . .
  - 1. Hilum *or* scar.
  - 2. Seed-coats.
  - 3. Kernel *or* nucleus
    - Embryo
      - Plumule.
      - Radicle.
    - Albumen.
- II. KINDS . . .
  - 1. Dicotyledons, exalbuminous. — *Bean*, *pea*, etc.
  - 2. Monocotyledons, albuminous. — *Corn*, *wheat*, *rice*, etc.
- III. CONDITIONS OF GERMINATION
  - Warmth.
  - Moisture.
  - Dissolved food.
  - Air (vital force).
- IV. USES . . . .
  - 1. To produce new plants.
  - 2. For medicines.
  - 3. For food.
  - 4. For making starch.
  - 5. For making oil.
  - 6. For fertilizers.
  - 7. For distilling.
  - 8. For fuel.




**TAP ROOTS.**

I. Tap or Primary Root, with branches.
II. Conical.
III. Fusiform.
IV. Napiform.

**FIBROUS ROOTS.**

V. Fibrous.
VI. Moniliform.
VII. Tubercular.
VIII. Fasciculated.

## LESSON II.

### The Root.

*Teacher.* (Presenting tap-roots to the class, one to each pupil.) What are these?

*Child.* They are roots of plants.

*T.* From what did they grow?

*Ch.* They grew from seeds.

*T.* From what part of the seed did they grow?

*Ch.* They grew from the embryo.

*T.* How many parts has the embryo?

*Ch.* It has two parts, the plumule and the radicle.

*T.* From which part of the embryo does the root grow?

*Ch.* It grows from the radicle, or root end.

*T.* Examine the specimens I have given you, and find the part which grew from the plumule.

*Ch.* This part, the stem, grew from the plumule. (Class decision. T. confirm.)

*T.* Trace the stem downward as far as it goes. Now what do you observe in regard to the growth of the root from that place?

*Ch.* It seems that the root is a part of the stem.

*Ch.* It is like the stem growing downward.

*T.* Yes, it does seem like the prolongation of the stem downward. Later, you will observe differences between the root and stem. At present you may describe this root.

*Ch.* (Measuring.) It is about four inches long.

*Ch.* (Measuring.) It is about one inch thick at the largest part.

*Ch.* It is largest near the stem.

*Ch.* It tapers to a point towards the other end.

*T.* You may describe the shape.

*Ch.* It is long, and round, and tapering.

*T.* Describe the surface.

*Ch.* The surface is smooth. (T. show *root-hairs.*)

*Ch.* The root which I have has a ridgy surface.

*T.* Mention anything else that you observe.

*Ch.* The color of this root is pale yellow, or yellowish white. (There will doubtless be many different colored roots, and the T. will have children observe this, and state that they are of different colors.)

*T.* Mention anything else that you observe.

*Ch.* There are ever so many little things growing out from the root.

*T.* From what part of the large root do they grow?

*Ch.* They grow from the sides of the large root.

*T.* Where on the sides of the large root are they in regard to each other?

*Ch.* They are at different places along the sides.

*T.* Who can think of a name for them?

*Ch.* They are little branches. (Class decision. T. confirm.)

*T.* Yes, you may call them branches. What may you call the large root?

*Ch.* We may call it the chief root.

*T.* Who can think of another word that means the same as *chief?*

*Ch.* Main root.

*T.* Yes, you may call it the main or *tap-root.* (Simultaneous recitation. T. write on board word *tap-root.*)

*T.* You may describe a tap-root.

*Ch.* A tap-root is a main root, with branches growing from different places along the sides.

*T.* Find other tap-roots. (Children find several and describe.)

*T.* Now find a root that is not a tap-root.

*Ch.* This is not a tap-root.

*T.* Why do you say it is not a tap-root?

*Ch.* Because it has no main root. (Class decision. T. confirm.)

*T.* Of what is that root composed?

*Ch.* It is composed of a great many (a cluster) little branches.

*T.* What do those branches look like?

*Ch.* They look like little threads. (Class decision. T. confirm.)

*T.* They do look like little threads, and for that reason they are called *fibres.* From what do these fibres grow?

*Ch.* They grow from the end of the stem. (Class decision. T. confirm.)

*T.* From what does the tap-root grow?

*Ch.* It grows from the radicle, and it seems to be the stem growing downward; but these roots branch out from the stem.

*T.* You may find other roots like these. (Children find several, describing each.)

*T.* Since this root is composed of many (or a cluster) small fibres growing from the end of the stem, what do you think we may call this kind of root?

*Ch.* We may call it a *fibrous root.* (Class decision. T. confirm.)

*T.* It is called a *fibrous root.* (Simultaneous recitation. T. write on board words *fibrous root.*) Now find both tap-roots and fibrous roots. (Children find several, and describe.)

*T.* What is a fibrous root?

*Ch.* A fibrous root is one that is composed of many (or of a cluster of) small fibres growing from the end of the stem.

NOTE. — The teacher may now teach axial and inaxial, as applying to tap and fibrous roots; may also explain use of terms *primary* and *multiple-primary,* as applied to roots; and may teach that *tap-roots* are called *true-roots,* while *fibrous roots* are called *adventitious roots;* also that roots growing from any part of the stem are called adventitious roots. Monocotyledonous seeds produce adventitious roots. Dicotyledonous seeds produce either tap-roots or adventitious roots.

*T.* How many classes of roots have we described?

*Ch.* We have described two classes, tap-roots and fibrous roots.

*T.* (Presenting roots.) Each child may select a tap-root. (Children select, and perhaps spend some time in determining such roots as the bean. After which, fibrous roots may be for the present removed.)

*T.* John, you may describe the root which you have, thinking of its shape.

*Ch.* This root is round. It is large near the stem, and tapers to a point towards the other end.

*T.* What object have you seen that this root resembles in shape?

*Ch.* It is shaped something like a cone. (Class decision. T. confirm. If the pupils have not had lessons in "Form," they will probably not know the term *cone,* in which case the T. will show them a cone, and let them perceive the resemblance between it and the root.)

*T.* All who have roots that are cone-shaped may hold them up. (Children do so, and describe.)

*T.* Mary may go to the table and find other roots of this shape. (Ch. does so, describing each.)

*T.* This is called a *conical root.* (Simultaneous recitation. T. write on board words *conical root.*)

*T.* John, you may describe the root which you have, thinking of its shape.

*Ch.* This root tapers to a point, as the conical root does.

*T.* Where is the conical root largest?

*Ch.* It is largest near the stem.

*T.* Where is the root which you have the largest?

*Ch.* It is largest near the middle. (Class decision. T. confirm.)

*T.* Now describe it as to the way in which it tapers.

*Ch.* It tapers towards both ends.

*T.* Find other roots of this shape. (Children find several, describing each.)

*T.* This is called a *fusiform* (or spindle-shaped) root. (Simultaneous recitation. T. write on board *fusiform root.* May show here a picture of a spindle filled, and describe.)

*T.* Jane, you may describe the root which you have, thinking of its shape.

*Ch.* This root has a face that is nearly circular, and the stem grows upward from the center.

*T.* Who can describe it further?

*Ch.* The upper part is large and nearly round, while the lower part is slender and tapers to a point.

*T.* Find other roots of this shape. (Children find several, and describe each.)

*T.* This is called a *napiform* (or turnip-shaped) root. (Simultaneous recitation. T. write on board words *napiform root.*)

*T.* (Presenting a root.) What kind of root is this?

*Ch.* That is a conical root. (Class decision. T. confirm.)

*T.* What kind of root is this?

*Ch.* It is a fusiform root. (Class decision. T. confirm.)

*T.* What kind of root is this?

*Ch.* It is a napiform root. (Class decision. T. confirm.)

*T.* To which class of roots do these which you have described belong?

*Ch.* They belong to the class of tap-roots.

*T.* How many kinds of tap-roots have you found?

*Ch.* We have found three kinds of tap-roots, — conical, fusiform, and napiform roots.

NOTE. — T. will here lead the pupils to perceive that these roots store up nourishment which serves for food for animals; that this storing up takes places during the first year of growth, and that, if allowed to grow a second year, this nourishment will be used by the plant. The T. will then remove tap-roots, and presenting fibrous roots, lead pupils to describe the different kinds. First, the fibrous root, which is composed of long thread-like roots growing from the end of the stem. Second, the *fasciculated root* which is composed of branches or fibres that have each stored up nourishment along its length, and which looks like a bundle of fusiform roots. The crowfoot, peony, and dahlia furnish examples of fasciculated roots. Third, the *moniliform root*, which is a fibrous root, the branches or fibres of which store up nourishment at intervals along their length, and have the appearance of strings of beads. The nut-grass of the South has a root of this kind. Fourth, the *tubercular root*, some of whose fibres store up nourishment in a somewhat globular form. The root of the *rue anemone* is tubercular. Drill upon classes and kinds of roots by having pupils select name and describe, by having them recall such roots as they remember belonging to either class or kind, and by having them draw different roots. It may be well to suggest here that it is perhaps not best to send some pupils to the board to draw, while others are describing, as the attention of either part of the class is not then concentrated upon one thing. Let all observe and describe, and then let all draw at the same time.

*T.* What do roots need in order to grow?
*Ch.* They need air.
*Ch.* They need moisture.
*Ch.* They need warmth.
*Ch.* They need soil.
*Ch.* They need darkness.

NOTE. — The T. will (if possible) show pupils plants whose roots live in the water. *Aquatic roots.* The water chickweed is an example. *Aerial roots,* of which the mangrove, some sugar canes, and the banyan, furnish examples, are sent out from stems into the open air, and at length reach the ground and there behave as ordinary roots. Such plants as the ivy and trumpet creeper send out *aerial rootlets,* or hooks, which hold the stems in place, by fastening into walls or trunks of trees. The most truly *aerial roots* are those which live entirely upon the air. The Spanish moss of the South, some lichens and many species of orchids, have roots of this kind. The mistletoe, dodder (cuscuta), and Indian pipe (monotropa) have *parasitic roots* (*all the above are adventitious roots*).

*T.* We have now to think of the uses of roots.
*Ch.* They absorb nourishment from the earth, and convey it to the stem.
*Ch.* They hold the plant in place.
*Ch.* They store up nourishment.
*Ch.* They produce new plants.
*Ch.* They are used for food.
*Ch.* They are used for medicines.
*Ch.* They are used for dyeing.
*Ch.* They supply fuel.
*Ch.* They supply timber for ships.

NOTE. — The T. will lead the children to perceive which of these uses are common to all roots, and, as far as possible, to state what roots are used for food, what roots for medicine, etc. He may also lead them to see that the root-hairs are very important in the work of absorbing nourishment, and that growth, in length, takes place at the extreme end of the root. He may also teach that roots may be classified according to duration, into *annual, biennial,* and *perennial roots. Annual roots* are those which live but one season. (The grains afford good examples of these.) *Biennial roots* die at the close of the second season. The first year is spent in storing up nourishment which is spent the second year in producing the aerial parts of the plant. Carrots, beets, parsnips, have all *biennial roots. Perennial roots* are those that last from year to year. The roots of trees and shrubs are good examples. *Annual roots* are always

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

## LESSON III.

### THE STEM.

*Teacher.* (Presenting stems to class, one to each pupil.) What are these?

*Child.* They are the stems of plants.

*T.* Examine these stems, and find how many parts each has.

*Ch.* (Examining closely the end. If he cannot see the end plainly, the T. will allow him to cut it.) This stem has three parts. (Class decision. T. confirm.)

*T.* Name those parts in order.

*Ch.* The bark, wood, and pith.

*T.* How many have stems whose parts are bark, wood, and pith? (All have.)

*T.* You may think of some stems you know, whose parts are bark, wood, and pith. (Children name several. T. may here lead pupils to see that the bark is also composed of parts, and if they are old enough to understand, may show, under the microscope, sections of stems, showing the different layers; may also show them where growth takes place.)

*T.* There are other parts of the stem which you cannot distinguish with the naked eye. Since this is so, what parts shall we call those which we can so easily see?

*Ch.* We may call them the principal (chief) parts.

*T.* What are the principal parts of a stem?

*Ch.* The parts of a stem are the bark, wood, and pith.

*T.* Examine your stems, and mention one thing that you observe.

*Ch.* I see something that looks like a little knot on the stem. (Class decision. T. confirm.)

*T.* Each one find as many of these little knots as you can on your stem. (Children count *nodes.*)

*T.* (Presenting stems bearing buds and leaves.) Examine these stems, and tell me whether you find little knots on them.

*Ch.* Yes; these stems have little knots.

*T.* What do these little knots mark on the stem?

*Ch.* They mark the places where the buds and leaves grow.

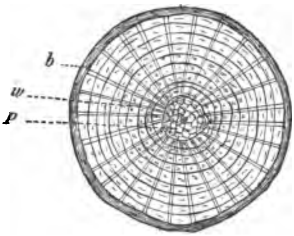
*T.* Which grows first, the bud or the leaf?

*Ch.* The bud grows first. (Class decision. T. confirm.)

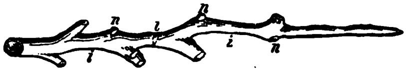
*T.* The places (points) from which the buds grow are called *nodes.* (Simultaneous recitation. T. write on board word *nodes.*)

*T.* Show me places on the stem from which no buds grow. (Children show *internodes.*)

I.



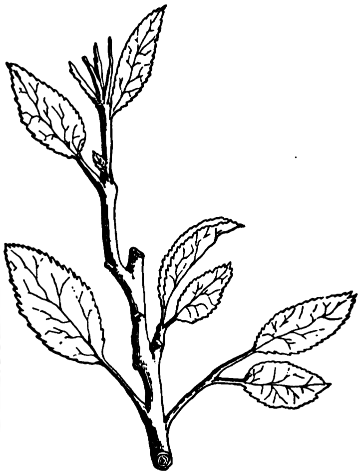

II.




III.

IV.

V.



I. Stem.
*b* Bark.
*w* Wood.
*p* Pith.

II. Stem.
*n n n* Nodes.
*i i i* Internodes.

III. Viola Cordata. Showing subterranean stem or root-stock.

IV. Geranium Maculatum. Wild Cranesbill. Showing thickened root-stock.

V. Stem. Showing nodes with leaves growing from them.

*T.* Where are these places in regard to the nodes?

*Ch.* They are between the nodes.

*T.* They are called by a name which means just what you have said, *internodes.* (Simultaneous recitation. T. write on board word *internodes.*)

*T.* What are the nodes and internodes of the stem?

*Ch.* They are parts of the stem. (T. give term *divisions* instead, as *parts* are bark, wood, and pith.)

*Ch.* The divisions of a stem are nodes and internodes. (T. may here teach *leaf axil*, which is the angle between the upper side of the leaf and the stem.)

*T.* (Presenting stems bearing appendages of different kinds.) Name one thing that grows from these stems.

*Ch.* Buds grow from this stem.

*Ch.* Leaves grow from this stem.

*Ch.* Branches grow from this stem.

*Ch.* Flowers grow from this stem.

*Ch.* I do not know what these little things on my stem are.

*T.* You may describe them.

*Ch.* They are like little hairs curled nearly round.

*T.* Who knows what they are? (Children do not know.)

*T.* They are called *tendrils.* Who knows what they are for?

*Ch.* They are to support the stem. (T. show pea and grapevine when growing.)

*T.* What have we found on these stems?

*Ch.* We have found buds, branches, leaves, flowers, and tendrils.

*T.* What are they of the stems?

*Ch.* They are the things that are attached to the stems.

*T.* Then what may we call them of the stems?

*Ch.* We may call them attachments of the stems.

*T.* They are called *appendages* of stems. (Explain word *appendages.*) You may name them.

*Ch.* The appendages of stems are buds, leaves, branches, flowers, and tendrils. (Lead pupils to state that all stems do not bear tendrils.)

*T.* Describe the stem you have, thinking of its size.

*Ch.* The stem I have is long. (Class decision. T. confirm.)

*T.* Suppose it were growing, how would you describe its length?

*Ch.* I should say, it is a high stem.

*T.* All who have high stems may hold them up. (Children do so.)

*T.* Yes, these seem to be quite high stems. Think of some stems that are higher than these.

*Ch.* The stems of trees are higher than these. (Class decision. T. confirm.)

*T.* Comparing them with stems of trees, what may you say these are, thinking of their lengths?

*Ch.* They are low stems. (Class decision. T. confirm.)

*T.* Find other low stems. (Children do so, describing.)

*T.* In what other direction must you observe them to get an idea of size?

*Ch.* We must observe their size round. (Class decision. T. confirm.)

*T.* Thinking of their size round (circumference), what kind of stems may you call them?

*Ch.* They are slender stems. (Class decision. T. confirm. Ch. may say they are *thin* stems, if so, T. may give term *slender.*)

*T.* Comparing the stems of trees with these, thinking of circumference, what kind of stems may you call them?

*Ch.* The stems of trees are thick stems.

*T.* Name as many plants having thick stems as you can. Name as many having slender stems as you can. Name as many having high stems, and as many having low stems as you can. Name stems that are high and slender. Name stems that are low and thick. (Children name many, making full statements about each.)

*T.* What have you learned that a stem may be in regard to size?

*Ch.* The size of a stem may be high or low, thick or slender.

*T.* What is the form of the stem you have?

*Ch.* The form of the stem I have is round. (Class decision. T. confirm. Write on board word *round.*)

*Ch.* The stem I have is rounded and a little flattened. (Class decision. T. confirm, giving term *compressed.* Write on board.)

*Ch.* The stem I have is flat on one side and curved on the other. (Class decision. T. confirm, giving term *half-rounded.* Write on board.)

*Ch.* The stem I have has little ridges with hollows in between.

*T.* In what direction do the ridges run?

*Ch.* They run along the length. (Class decision. T. confirm, giving term *grooved.* Write on board.)

*Ch.* The stem I have has three sides.

*T.* How do those sides compare in length and width with each other?

*Ch.* They are equal. (Class decision. T. confirm, giving term *triangular.* Write on board.)

NOTE.—The forms of stems are almost innumerable, and children enjoy finding and describing them. There being no new development work required here, as children make full description and the T. gives the term, there is no necessity for going through the whole list, but the T., of course, will not omit any forms.

*T.* What have you learned that the form of a stem may be?

*Ch.* The form of a stem may be rounded, compressed, half-rounded, grooved, triangular, acute-angled, square, four-angled, five-sided, etc.

*T.* Describe the stem you have, thinking of its surface.

*Ch.* The surface of this stem is smooth.

*Ch.* The surface of this stem is rough.

*Ch.* The surface of this stem is hairy.

*T.* All who have stems with hairy surfaces may hold them up. (Children do so, describing.)

*T.* Those whose stems have not hairs on the surface may hold them up. (Children do so.)

*T.* What is true of the surface of the stem you have?

*Ch.* The surface is covered with something like down. (Class decision. T. confirm, giving term *downy.*)

*T.* Who has a stem with a surface different from any we have mentioned?

*Ch.* The surface of this stem is glossy. (Class decision. T. confirm.)

*T.* John, what is true of the surface of the stem you have, thinking of the one that is glossy?

*Ch.* The surface of this stem is not glossy. It is dull. (Class decision. T. confirm.)

*T.* You may describe the stems you have whose surfaces are different from any we have observed.

*Ch.* The surface of this stem is covered with sharp things. (Class decision. T. confirm, giving word *prickly.*)

*Ch.* This stem is thorny. (Class decision. T. confirm, showing the difference between prickles and thorns. The prickles come off with the bark; the thorns are part of the wood.)

*T.* Those who have stems whose surfaces have none of the things mentioned, neither hairs nor down nor prickles, etc., may hold them up. (Children show several, and T. gives term *glabrous.*)

*T.* What have you learned in regard to the surface of a stem?

*Ch.* The surface of a stem may be smooth, rough, hairy, downy, glossy, dull, prickly, thorny, glabrous, etc.

*T.* You may now speak of the color of these stems.

*Ch.* This stem is red.

*Ch.* This stem is green.

*Ch.* This stem is brown.

*Ch.* This stem is gray.

*Ch.* This stem is yellow.

*Ch.* This stem is purple (or purplish).

*Ch.* This stem is bluish.

*Ch.* This stem is spotted. (Names color of spots.)

*Ch.* This stem is striped. (Names color of stripes.)

NOTE. — The T. will not expect to get statements from pupils as glibly as they are given here. Many pupils will not know color, and the T. must work very slowly and carefully.

*T.* John, stand out on the floor and show the class the direction in which the stem you have grew. (John places the plant on the floor, and, holding the stem upright, states that it grew in that direction.)

*T.* That is correct, and we call a stem that grows in that direction or attitude an *erect* stem. (Simultaneous recitation. T. confirms *erect.*)

*T.* Henry, you may show the attitude of your stem while growing.

*Ch.* (Showing as John did.) The upper part of this stem droops over. (Class decision. T. confirm.)

*T.* Who can think what we may call that stem, thinking of its attitude?

*Ch.* It is a drooping stem. (Simultaneous recitation. T. write on board word *drooping.*)

*T.* Name all the drooping stems of which you can think. (Children name several, making a full statement about each.)

*T.* Jane, describe your stem, thinking of its altitude.

*Ch.* (Showing with plant.) This stem seems to be on the ground. (Class decision. T. confirm.)

*T.* What way does that stem differ from the others?

*Ch.* It has little hair-like things on the surface.

*T.* From what portion of the stem do they grow?

*Ch.* They grow from the nodes. (Class decision. T. confirm.)

*T.* What are they like?

*Ch.* They are like little roots. (Class decision. T. confirm.)

*T.* They are like what class of roots?

*Ch.* They are like fibrous roots.

*T.* They are fibrous (adventitious) roots, sent out from the nodes for what purpose?

*Ch.* They are sent out from the nodes into the earth to draw up nourishment for the stem. (Class decision. T. confirm.)

*T.* And in what altitude do they keep the stem?

*Ch.* They keep it fastened close to the ground.

*T.* Name any stems you can that have this attitude. (Children name several, describing each in regard to attitude.)

*T.* This is called a creeping stem. (Simultaneous recitation. T. write on board word *creeping.*)

*T.* Susan, describe the stem you have, thinking of its attitude.

*Ch.* This stem lies along the ground.

*T*. How does it differ from the creeping stem?

*Ch*. It has no roots growing from the nodes.

*T*. Name as many stems as you can that lie loosely along the ground in this way. (Children name several, making a full statement about each.)

*T*. This stem is called a trailing stem. (Simultaneous recitation. T. write on board word *trailing*.)

*T*. Who has a stem whose attitude is different from any we have mentioned?

*Ch*. This stem grows around a post or stick. (Class decision. T. confirm.)

*T*. Describe how it grows round the support.

*Ch*. It twists (twines) itself round the support.

*T*. Mention all the stems you can that twine in this way. (Children mention several, making full statements.)

*T*. Who can make a name for this stem?

*Ch*. It is a twining stem. (Simultaneous recitation. T. write on board word *twining*. Possibly pupils may say it is a climbing stem. If so, T. will show them that that is true, but since it climbs by twining, we call it a twining stem.)

*T*. Describe another stem, thinking of its attitude.

*Ch*. This stem climbs. (Class decision. T. confirm.)

*T*. Describe the way in which it climbs.

*Ch*. It has tendrils which it winds round a support, and climbs in that way.

*T*. Who knows of a stem that climbs in some other way?

*Ch*. The ivy climbs in another way.

*T*. How does it climb?

*Ch*. (Examining.) It sends out little things that look like teeth that fasten into the support, and it climbs by means of them.

*T*. What do these little teeth do?

*Ch*. They hold the plant in place. (Class decision. T. confirm.)

*T*. Then what may we call them?

*Ch*. We may call them roots. (Class decision. T. confirm, referring to *aerial* rootlets.)

*T*. What kind of stems may we call these, thinking of their attitude?

*Ch*. They are climbing stems. (Simultaneous recitation. T. write on board word *climbing*.)

*T*. Who has a stem that has an attitude different from any we have mentioned?

*Ch*. I have the stem of a rosebush, and I can hardly describe its attitude.

*T*. Name one thing in regard to the attitude.

*Ch.* This part (to top) is erect, but I think this part grew along the ground.

*Ch.* That part grew under the ground.

*T.* Look at that part closely and tell me what you find on it.

*Ch.* I find *nodes* on it.

*T.* What do you find growing from the nodes?

*Ch.* I find branches that ran up through the earth.

*T.* How many think this part is a part of the stem? (All think so.)

*T.* Why do you think it is a part of the stem?

*Ch.* Because it has nodes. A root has no nodes. (Class decision. T. confirm.)

*T.* Mention any stems you can that grow in the same way. (Children mention several, making full statements about each.)

*T.* We call this an *ascending stem.* (Simultaneous recitation. T. write on board word *ascending.*)

*T.* How many different kinds of stems have you found, thinking of their attitude?

*Ch.* We have found erect, drooping, creeping, trailing, twining, climbing, and ascending stems. (Simultaneous recitation. After which T. has pupils describe each fully.)

*T.* Now examine these stems at which you first looked, and name parts of each.

*Ch.* The parts of each of these stems are, the bark, wood, and pith.

*T.* Where are these parts situated in regard to each other?

*Ch.* The bark is outside, the wood is next to the bark, and the pith is next the wood, in the center. (Class decision. T. confirm.)

*T.* Find other stems in which the parts are arranged in the same way. (Children find several, describing each.)

*T.* (Presenting pieces of stem of Indian corn.) Examine this stem, and describe the arrangement of parts in regard to each other. (Children can not describe.)

*T.* How many parts do you find?

*Ch.* We find three parts, as in the other stems.

*T.* Where is the wood in regard to the pith?

*Ch.* (After some examination find wood.) The wood is mixed up with the pith. (Class decision. T. confirm.)

*T.* Name any stems you can whose parts are arranged as in the Indian corn. (Probably children know of none, in which case the T. names several.)

*T.* We call this an *exogenous stem* where the wood grows between the bark and the pith; and this stem in which the wood is mixed up with the pith is an *endogenous stem.* (Simultaneous recitation. T. write on board *exogenous* and *endogenous.* Give meanings of terms

*outside growers*, and *inside growers*. Show that *dicotyledonous* seeds produce *exogenous stems*, and *monocotyledonous* seeds produce *endogenous stems*. Show that in an *endogenous stem* the bark is not distinct, as in *exogenous stems*.)

*T*. Thinking of their manner of growth, how many classes of stems have you learned?

*Ch*. We have learned two classes, *exogenous* and *endogenous stems*. (Have pupils describe each.)

*T*. You may each break a stem. (Children do so.) Jane, what is true of the ease with which you broke yours?

*Ch*. Mine broke very easily.

*T*. How many have stems that broke very easily? (Pupils state.)

*T*. How many have stems that did not break easily? (Pupils state.)

*T*. Why did your stem break so much more easily than the one John has?

*Ch*. (Examining.) His stem is solid and mine is hollow. (Class decision. T. confirm.)

*T*. What other reason is there?

*Ch*. My stem has not much wood, and his has a great deal. (Class decision. T. confirm.)

*T*. How many have stems that have a great deal of wood? (Pupils state.)

*T*. You may name as many stems as you can that have a great deal of wood. (Children name trees and shrubs.)

*T*. Who can think of a good name for stems that have a great deal of wood?

*Ch*. We might call them *woody* stems. (Class decision. T. confirm. Write on board word *woody*.)

*T*. Who knows a name for those stems that have but little wood, and many of which are hollow? (Children do not know. T. give term *herbaceous* stems. Write on board.)

*T*. Name all the herbaceous stems of which you can think. (Children name several, making full statements about each. T. here lead pupils to state that all herbaceous stems are *annual*, and die down every year; that a plant may have an *annual* stem and a *biennial* root; that woody stems are biennial or perennial, and belong to shrubs and trees, while herbaceous stems belong to the division of herbs.)

*T*. Compare the stem with the root, and state one difference that you observe.

*Ch*. (Examining.) The stem is green, and the root is whitish.

*T*. State another difference between them.

*Ch*. This stem has buds, and the root has not. (Class decision. T. confirm.)

*T.* What do all stems that you know produce?
*Ch.* All stems that I know produce buds.
*T.* From what do those buds grow?
*Ch.* They grow from the nodes.
*T.* Who knows a root that has nodes? (Children do not know any such.)
*T.* What grows from nodes?
*Ch.* Buds and leaves or branches grow from nodes.
*T.* (Presenting potatoes.) What are these?
*Ch.* They are roots. (Children have heard the potato called a root.)
*T.* What do they produce?
*Ch.* They produce plants.
*T.* From what part does the plant grow?
*Ch.* It grows from the eye.
*T.* What grows from the eye first?
*Ch.* A bud grows from it.
*T.* From what do buds grow?
*Ch.* Buds grow from nodes.
*T.* Then what do you think this that you call the eye is?
*Ch.* I think it is a node. (Class decision. T. confirm.)
*T.* Nodes are divisions of what part of the plant?
*Ch.* Nodes are divisions of the stem.
*T.* What is true of the root in regard to nodes?
*Ch.* The root has no nodes. (Class decision. T. confirm.)
*T.* Then, since this has nodes from which buds and branches grow, what do you think it is?
*Ch.* I think it is a stem. (Class decision. T. confirm.)
*T.* Where does it grow in regard to the ground?
*Ch.* It grows under the ground.
*T.* Where do the greater number of stems that you know grow?
*Ch.* They grow above the ground (in the air).
*T.* What name shall we give those stems that grow in the air?
*Ch.* We may call them *aerial stems.* (Class decision. T. confirm. Simultaneous recitation. T. write on board words *aerial stems.*)
*T.* What shall we call those stems that grow under the ground?
*Ch.* We shall call them *underground stems.* (Class decision. T. confirm, and gives words *subterranean stems* instead. Simultaneous recitation. T. write on board words *subterranean stems.*)
*T.* Name five aerial stems. (Children do so, making full statements.)
*T.* Name as many subterranean stems as you can. (Children do not know many subterranean stems, and T. must have as many specimens to show as possible.)
*T.* According to position, how many classes of stems have you found?
*Ch.* We have found two classes of stems, according to position: aerial stems and subterranean stems.

NOTE. — The T. may, after finishing classes of stems, spend one or two recitations upon sap, and the different gums, referring to them in the work upon *Uses* that will come last of all. He will take up the uses of bark, wood, pith, sap, and gums, separately. The subject of sap rising through the stem to the branches and leaves, there receiving oxygen, and then returning through the tree and depositing the layer which on one side becomes wood and on the other bark, is of the greatest interest, and may be shown to comparatively young pupils. It might be well, here, to have the pupils study the bark and find the different layers. The work in writing and drawing ought to go on each day as usual.

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## SUMMARY OF WORK UPON STEMS.

### *The Stem.*

| | | |
|---|---|---|
| I. PARTS | Bark. — Parts of bark.<br>Wood.<br>Pith. | |
| II. DIVISIONS | Nodes.<br>Internodes.<br>(Leaf axil.) | |
| III. APPENDAGES | Buds.<br>Branches.<br>Leaves.<br>Flowers.<br>Tendrils.<br>(Rootlets.) | |
| IV. SIZE | High<br>Low<br>Thick<br>Slender | *Trees.*<br>*Shrubs, herbs.*<br>*Trees.*<br>*Shrubs, herbs.* |
| V. FORM | Rounded.<br>Compressed.<br>Half-rounded.<br>Grooved.<br>Triangular.<br>Acute-angled.<br>Square.<br>Four-angled.<br>Five-sided.<br>Six-sided. | |
| VI. SURFACE | Smooth.<br>Rough.<br>Hairy.<br>Downy.<br>Glossy.<br>Dull.<br>Prickly.<br>Thorny. | |

- **VII. Color**
  - Green.
  - Brown.
  - Red.
  - Gray.
  - Yellow.
  - Purple.
  - Bluish.
  - Striped.
  - Spotted.
- **VIII. Altitude**
  - Erect, branching. — *Trees* and *shrubs.*
  - Erect. — *Grasses, corn, sugar-cane.*
  - Drooping. — *Fuchsia.*
  - Creeping. — *White-clover, strawberry.*
  - Trailing. — *Knot-grass.*
  - Twining. — *Morning-glory, bean.*
  - Climbing.
    - 1. *By tendrils, pea, grape-vine.*
    - 2. *By rootlets, ivy, trumpet-vine.*
  - Ascending. — *Rose-bush.*
- **IX. Class 1, as to Manner of Growth**
  - Exogenous, dicotyledons.
  - Endogenous, monocotyledons.
- **X. Class 2, as to Structure.**
  - Woody (perennials, some biennials).
  - Herbaceous (annuals).
- **XI. Class 3, as to Position**
  - Aerial
    - Culm (jointed). — *Grasses, sedges.*
    - Caudex (scaly). — *Palm.*
    - Scape. — *Dandelion.*
  - Subterranean
    - Rhizoma. — *Wild cranesbill, calamus.*
    - Tuber. — *Potato.*
    - Bulb. — *Onion, lily.*
    - Conn. — *Indian turnip, crocus.*
- **XII. Uses**
  - A.
    1. To convey nourishment to branches and leaves.
    2. To store up nourishment.
    3. To produce new plants.
    4. To support appendages.
    5. For food (sugar-cane, rhubarb, grasses, corn-stalks).
    6. For fuel.
    7. Timber and lumber (pine, spruce, maple, etc.).
    8. For medicines (mints).
    9. Baskets, chairs, etc. (willows).
  - B. Uses of Bark
    - Protects wood in trees and shrubs.
    - For boxes and canoes (birch).
    - Spice (cinnamon).
    - Cork.
    - Medicine (cinchona, Peruvian bark).
    - Linen (flax).
  - C. Use of Sap
    - Sugar (sugar maple, sugar-cane).
  - D. Use of Gums
    - Rubber.
    - Gum-arabic.
    - Turpentine (pine).
    - Spruce gum.

## LESSON IV.

### SUMMARY OF WORK UPON BUDS.

*The Bud.*

| | |
|---|---|
| I. Parts | Leaves or flowers.<br>Stem.<br>Scales, Gum, Cotton — Protect leaves, flowers, stem, etc., from cold, dampness, sudden changes of weather, etc. |
| II. Classes as to what they Produce | Leaf buds.<br>Flower buds. |
| III. Classes as to Position on the Stem | Terminal (growing from apex of the stem). — Maple, hickory, horse-chestnut, etc.<br>Lateral (growing from sides of the stem).<br>Axillary (growing from the axils of leaves). — Locust, buttonwood.<br>Supernumerary (two or more growing in addition to the ordinary axillary bud).<br>Adventitious (growing without order from stems, roots, or leaves). |
| IV. Kinds as to Covering | Scaly. — Horse-chestnut, hickory, etc. (Found generally on trees of northern climates.)<br>Naked. — Sumac, honey locust, etc. (Found on herbs of all climates; also found on perennials in tropical regions.) |
| | Latent buds are those which survive long without developing. They are generally invisible externally. |
| V. Conditions of Growth | Nourishment.<br>Light.<br>Warmth.<br>Air. |
| VI. Uses | To produce the aerial parts of the plant. |

## LESSON V.

### SUMMARY OF WORK UPON LEAVES.

#### *The Leaf.*

- **I. Parts**
  - Blade
    - Description (full).
    - Veins (mid-vein, small veins and veinlets).
    - Parenchyma (pulpy or fleshy part).
  - Petiole
    - Description (full).
    - Bundle of woody fibres.
    - Stipules.
- **II. Classes as to Blade**
  - Simple.
  - Compound.
- **III. Classes as to Venation**
  - Net-veined (exogenous)
    - Palmate. — Maple.
    - Pinnate.—Apple, birch, peach, etc.
    - Furcate *or* forked.
  - Parallel-veined (endogenous)
    - From base to apex. (Parts: blade, sheath, and ligule). — Grasses, corn, etc.
    - From mid-rib to margin.
- **IV. Classes as to Insertion**
  - Petiolate (attached by a petiole. May be stipulate or exstipulate).
  - Sessile (without a petiole; sitting on the stem. May be stipulate or exstipulate).
- **V. Classes as to Position**
  - Cauline (growing along the stem).
  - Radical (growing from the stem close to the ground).
- **VI. Phyllotaxy, *or* Arrangement on the Stem**
  - Alternate (one leaf growing from a node). — Apple, oak, etc.
  - Opposite (two leaves growing from a node). — Maple, lilac, etc.
  - Verticillate *or* whorled (three or more leaves growing from a node). — Madder, etc.
- **VII. Vernation, *or* Arrangement in the Bud**
  - Induplicate *or* inflexed (folded crosswise).—Tulip tree.
  - Conduplicate (folded along the mid-rib). — Oak, cherry.
  - Plicate (folded like a fan). — Maple, currant.
  - Circinate (rolled lengthwise). — Fern, sundew.
  - Convolute (rolled edgewise). — Cherry, plum.
  - Involute (both edges rolled inward towards the mid-rib). — Apple, violet.
  - Revolute (both edges rolled outward). — Willow, azalea.

- VIII. FORMS OF LEAVES . .
  - Broadest in the Middle
    - Peltate, oval, orbicular.
    - Elliptical, oblong.
    - Linear, acicular.
    - Acrose.
  - Broadest at the Base
    - Deltoid, ovate, lanceolate.
    - Subulate, cordate.
    - Reniform, hastate, sagittate.
  - Broadest at the Apex
    - Obcordiform, obovate.
    - Oblanceolate, spatulate.
    - Cuneate, obcordate.
    - Lyrate, runcinate.
- IX. FORMS OF BASES . . .
  - Cordate.
  - Auriculate.
  - Oblique.
  - Tapering.
  - Abrupt.
  - Clasping.
  - Perfoliate.
  - Connate.
  - Decurrent.
- X. FORMS OF APEXES . .
  - Acute.
  - Acuminate.
  - Obtuse.
  - Truncate.
  - Retuse.
  - Obcordate.
  - Emarginate.
  - Mucronate.
  - Cuspidate.
- XI. MARGINS . .
  - Entire.
  - Serrate.
  - Dentate.
  - Crenate.
  - Repand.
  - Sinuate.
  - Incised.
  - Lobed.
  - Cleft.
  - Divided.
  - Parted.
  - Compound .
    - Pinnate
      - Abruptly pinnate.
      - Unequally pinnate.
      - Interruptedly pinnate.
    - Bipinnate.
    - Tripinnate.
    - Five-fingered.
    - Seven-fingered.
    - Cirrose.

NOTE. — *Surface* and *Color* of leaves may be considered after Margins.

- XII. MOTIONS OF LEAVES . .
  - Turn towards the sun.
  - Venus' fly-trap.
  - Sensitive plant.

| | |
|---|---|
| XIII. MODIFICATIONS . . . | Venus' fly-trap.<br>Pitcher-plant.<br>Bracts.<br>Leafscales.<br>Thorns.<br>Prickles.<br>Cones. — Tendrils. |
| XIV. DURATION OF LEAVES . . | Fugacious (falling early; before the close of the season).<br>Deciduous (falling at the close of the season).<br>Persistent (remaining through the winter). |
| XV. USES . . . | Absorb nourishment from the atmosphere.<br>Act as lungs to the plant.<br>Used for food { Tea, palm. Cabbage, lettuce, etc.<br>Used in medicines.<br>Fibres of palm leaves used for thread in some countries. |

# LESSON VI.

## SUMMARY OF WORK UPON INFLORESCENCE.

### *Inflorescence.*

- I. PARTS.
  - Peduncle (stem of a simple flower, or of a cluster of flowers).
  - Scape (a naked peduncle).
  - Rachis (a peduncle from which flowers branch off).
  - Floret (one of the flowers of a cluster).
  - Pedicel (stem of a floret).
  - Bracts (small floral leaves growing from the peduncle).
  - Involucre (a whorl of bracts).
  - Receptacle (the top of a peduncle).
- II. CLASSES
  - Solitary
    - Terminal.
    - Axillary.
  - Clustered
    - Indefinite *or* indeterminate
      - Florets having pedicels.
        - Raceme (lily of the valley)
        - Corymb (yarrow)
        - Umbel (milkweed)
        - Panicle (oats)
        - Thyrsus (lilac)
      - Florets sessile.
        - Spike (plantain)
        - Spadix (calla lily)
        - Ament (willow)
        - Head (clover)
    - Definite *or* determinate
      - Cyme (elder).
      - Fascicle (sweet-william).
      - Glomerule (mint).
      - Verticillaster (motherwort).
      - Scorpioid (forget-me-not).

## LESSON VII.

### SUMMARY OF WORK UPON FLOWERS.

#### *The Flower.*

- I. PARTS . . .
  - Calyx (cup; the outer circle of floral leaves).
  - Corolla (crown; the inner circle of floral leaves).
  - Stamens (a thread; slender parts inside the corolla).
  - Pistil *or* pistils (the part or parts in the center, surrounded by the stamens).
  - Perianth (the calyx and corolla when not easily distinguished).
  - Receptacle (the part upon which the organs of the flower are inserted).
- II. PROTECTIVE ORGANS . . .
  - Calyx .
    - Sepals.
    - Monosepalous.
    - Polysepalous.
  - Corolla
    - Petals.
    - Monopetalous.
    - Polypetalous.
- III. ESSENTIAL ORGANS . . .
  - Stamens
    - Anther (pollen).
    - Filament.
    - Connective.
  - Pistil .
    - Stigma.
    - Style.
    - Ovary.
- IV. KINDS . . .
  - Complete (having four sets of organs present).
  - Perfect (having stamens and pistils present).
  - Symmetrical (same number of parts in each set of organs).
  - Regular (petals and sepals uniform).
  - Pedunculate (having a peduncle).
  - Sessile (without a peduncle).
  - Monœcious (stamens and pistils on same plant).
  - Diœcious (stamens and pistils on two different plants).

**V. Modifications of Type**

1. *By absence of parts:*
   - Of stamens, pistillate (imperfect).
   - Of pistil, staminate (imperfect).
   - Of calyx, asepalous (incomplete).
   - Of corolla, apetalous (incomplete).
2. *By variation from type number:*
   - Unsymmetrical (different number of parts in each set of organs).
3. *By variation in form and size of petals and sepals:*
   - Irregular (sepals and petals not uniform).
4. *By cohesion of parts of organs:*
   - Of sepals, monosepalous (myrtle).
   - Of petals, monopetalous (larkspur).
   - Of stamens, monodelphous (dandelion).
   - Of pistils, compound.
5. *By adhesion of parts of organs:*
   - Of stamens and petals (nearly all monopetalous flowers).
   - Of stamens to pistils (hollyhock, hibiscus).
   - Of sepals to petals (bishop's cap).
   - Of stamens to sepals (currant blossom).

### *The Calyx.*

**I. Description**
- Size.
- Form.
- Surface.
- Color.
- Cohesion (monosepalous, — truncate, toothed, lobed, cleft, parted).
- Adnation (inferior, half-inferior, superior).
- Æstivation (arrangement of sepals in buds).

**II. Parts**
- Sepals.
- Monosepalous calyx
  - Tube.
  - Teeth *or* lobes.
  - Throat.
- Pappus.

**III. Use** . . . . Protection to the other organs.

### *The Sepals.*

**IV. Description**
- Size.
- Form.
- Surface.
- Color.
- Texture.

### *The Corolla.*

- I. Description
  - Size.
  - Form.
  - Surface.
  - Texture.
  - Color.
  - Cohesion (truncate, toothed, lobed, cleft, parted).
  - Adnation (hypogynous, perigynous, epigynous).
  - Æstivation (arrangement of petals in the bud).
- II. Parts . . Petals
  - Lamina.
  - Claw.
  - Spur.
  - Crown.
- III. Uses . . .
  - Ornament.
  - Protection to internal organs (many corollas close in bad weather).
  - Attracts bees.
- IV. Description
  - Size.
  - Form.
  - Surface.
  - Texture.
  - Color.

### *Stamens.*

- I. Parts . .
  - Anther (contains pollen, hence the essential portion).
  - Filament (the stem bearing the anther).
  - Connective (the continuation of the filament uniting the lobes of the anther).
- II. Kinds . .
  - Sessile (anther having no filament).
  - Sterile (filament having no anther).
  - Connivent (stamens converging).
  - Exserted (stamens protruding beyond the corolla).
  - Included (stamens entirely within the corolla).
  - Didynamous (stamens four, two long and two short).
  - Tetradynamous (stamens six, four long and two short).
- III. Cohesion .
  - Syngenesious (stamens united by their anthers).
  - Monadelphous (stamens united by filaments into one set).
  - Diadelphous (stamens united into two sets).
  - Polyadelphous (stamens united into many sets).
- IV. Adnation .
  - Hypogynous (stamens borne on the receptacle).
  - Perigynous (stamens borne of the calyx).
  - Epipetalous (stamens borne on the corolla).
  - Alternate (stamens alternate with the lobes of corolla).
  - Opposite (stamens in front of lobes of corolla).
  - Epigynous (stamens on summit of ovary).
  - Gynandrous (stamens on the style, — orchids).

*Filament.*

| | |
|---|---|
| I. Kinds . . | Filiform.<br>Subulate.<br>Dilated.<br>Petaloid.<br>Bidentate. |

*Anther.*

| | |
|---|---|
| I. Parts . . | Lobes.<br>Connective. |
| II. Adnation . | Innate (anther firm on top of filament).<br>Adnate (anther attached by its whole length to filament).<br>Extrorse (anther facing the petals).<br>Introrse (anther facing the pistils).<br>Versatile (anther attached near the middle). |
| III. Dehiscence | Longitudinal (anther opening lengthwise).<br>Transverse (anther opening crosswise).<br>Porous (anther opening by terminal holes).<br>Valved (anther opening by valves or doors). |

*Pistils.*

| | |
|---|---|
| I. Parts . . | Stigma (the top or tip end to which pollen adheres).<br>Style (stem bearing stigma on its top).<br>Ovary (the portion at the base containing the ovules). |
| II. Cohesion . | Simple (having but one cell).<br>Multiple (a collection of distinct pistils).<br>Compound (several united *carpels*). |

*Stigma.*

| | |
|---|---|
| I. Kinds . . | Sessile (stigma and ovary, no style).<br>Globose (somewhat spherical in form).<br>Capitate (somewhat like the head of a pin).<br>Lobed (somewhat rounded).<br>Feathered (somewhat like a feather).<br>Linear (somewhat like a thread). |

*Style.*

| | |
|---|---|
| I. Kinds . . | Basal (to base of ovary).<br>Lateral (to side of ovary).<br>Terminal (to top of ovary). |

*Ovary.*

| | |
|---|---|
| I. Parts . . | Placenta (the surface to which ovules are attached).<br>Dissepiments (partitions of ovary).<br>Cells (cavities in which ovules are arranged).<br>Ovule (the body which, after fertilization, becomes a seed). |
| II. Adnation . | Inferior (calyx adheres to ovary).<br>Superior (calyx free from ovary). |

**III. Placentation**
- Free-central (ovary one-celled; ovules attached to a central column).
- Axillary (ovary compound; ovules attached to a central axis).
- Parietal (ovules borne on the walls of the ovary).

*Ovules.*

**IV. Parts**
- Nucleus (the part from which the embryo is developed).
- Primine (outer covering of the ovule).
- Secundine (inner covering of the ovule).
- Micropyle (the opening of the coverings of the ovary).
- Funiculus (the stem of a seed or ovule).
- Hilum (the scar, showing place of attachment of seed).
- Chalaza (point of union of coats and nucleus).
- Rhaphe (connection between nucleus and ovule).

**V. Kinds**
- Orthopterous (straight).
- Campylotropous (curved).
- Anatropous (inverted).
- Amphitropous (partly inverted).

**VI. Direction of Ovary**
- Erect.
- Ascending.
- Horizontal.
- Pendulous.
- Suspended.

**VII. Use of Stamens and Pistils**
- To fertilize the ovules and to produce seed.
- Agents in fertilization, — winds, honey-bees and other insects.

## ODORS OF FLOWERS.

### CAUSED BY THE PRESENCE OF VOLATILE OIL.

There is some connection or correspondence between the color and odor of flowers. White flowers are generally fragrant. Many flowers of dull hues are odorous, thus by their fragrance compensating for their lack of color. On the other hand, many of the gaily-colored flowers are either inodorous or emit a disagreeable perfume. The odors of flowers in a warm climate are not so fine and delicate, as a rule, as those of flowers growing in northern regions. A few lessons upon this topic would be of great interest and profit.

**Uses of Flowers**
- To produce fruit.
- To supply bees with material for making honey.
- To supply perfumes (roses).
- Used in medicines.
- For ornament.
- To fill the world with beauty.

## LESSON VIII.

### SUMMARY OF WORK UPON FRUITS.

#### *The Fruit.*

- I. PARTS
  - Seed.
  - Pericarp
    - Epicarp (the outer layer of the pericarp).
    - Mesocarp (the middle layer).
    - Endocarp (the inner layer).
- II. DEHISCENCE
  - Loculicidal (opening along the middle of the back of each cell). — Iris.
  - Septicidal (opening along the partitions). — Azalea, rhododendron.
  - Septifragal (valves break away from the partitions). — Morning-glory.
  - Circumcissile (pyxis; opening all round). — Plantain.
- III. CLASSES ACCORDING TO NUMBER OF PISTILS
  - Simple (having a single pistil, either simple or compound).
  - Compound *or* aggregate (many carpels clustered together on one receptacle; these carpels are called *Achenia*). — Strawberry.
  - Multiple (resulting from many flowers aggregated into a mass). — Pineapple.

#### *Simple Fruits.*

- I. KINDS
  - *Dry Fruits.* Dehiscent
    - Single pistil
      - Follicle (marsh marigold).
      - Legume (pea, bean).
      - Loment (desmodium *or* tick, trefoil).
    - Compound pistil
      - Capsule (any pod of a compound pistil).
      - Silique (mustard).
      - Silicle (shepherd's purse).
  - Indehiscent
    - Fleshy
      - Berry (currant, grape).
      - Hesperidium (orange).
      - Pepo (cucumber, squash, pumpkin).
      - Pome (apple, pear, quince).
    - Stone
      - Drupe (peach, plum, cherry).
      - Compound
        - Blackberry.
        - Raspberry.
    - Dry
      - Achenium (dandelion, succory).
      - Utricle (ligweed).
      - Caryopsis *or* grain (wheat, Indian corn).
      - Nut (cocoanut, chestnut).
      - Glans (acorn).
      - Samara (maple, ash, elm).
      - Strobile (a scaly multiple fruit, — hop-cones, juniper berry, and red cedar closed cones).

- USES OF FRUITS
  - To reproduce plants.
  - For food.
  - Used in medicines.

# LESSONS ON INSECTS.

## THE GRASSHOPPER.

### INTRODUCTION.

The aim of these lessons is not merely to put children in possession of a certain amount of scientific knowledge concerning insects, as such knowledge would of itself be of very little use, but the design is to enable them to express fluently and correctly such knowledge as they may gain. To this end particular attention must be given to oral language, penmanship, spelling, the use of capital letters, punctuation, composition, and drawing.

The object of language lessons is to teach pupils to talk and write correctly. If this work is carried on properly, every lesson will be a language lesson of much greater value than those we find in books arranged for the purpose. The child will have a subject full of interest about which he can talk and write. With a little care on the part of the teacher, the irksomeness of the mechanical part of the work need never be felt, and isolated lessons in spelling, writing, language, drawing, and composition may, to a great extent, be done away with. Though scientific work in entomology is only a secondary aim, the teacher will find that he is laying an excellent foundation for future scientific investigation, while the pupils are gaining power to observe, think, and talk intelligently upon many subjects besides the one under consideration.

As to the value of insect-lessons compared with that of any other branch of natural history, I think that it is of more worth than either mineralogy or botany, as children are more interested in studying animals than either stones or plants. The specimens are easily obtained, convenient to handle, while a consideration of the structure and uses of parts, together with the habits of these little creatures, affords matter for the deepest thought.

Another reason for the study of insects is that probably some knowledge in this direction may lead to the means of preventing the destruction yearly wrought in field and garden by these little creatures.

## Apparatus.

The teacher should be provided with cases for insects, and, as soon as lessons have begun, the children should employ every leisure minute in collecting material for future use. These cases may be made of soft wood, which may be stained to look like black walnut. A convenient length is three feet long by two and one-half wide, and four or five inches deep. The cover should be fastened with hinges and a lock or spring catch, and may be of glass. The cases may be lined with sheet cork covered with a layer of thick drawing-paper; or, several layers of drawing-paper will do very well without the cork. A small piece of cotton saturated with carbolic acid, and placed in one corner of the case, will be effective in keeping small insects that may be inclined to prey upon the specimens.

Besides the cases two or three setting-boxes will be needed. These may be of wood or thick paper (envelope boxes will do), having slats of cork or soft wood arranged lengthwise along the bottom. These slats must be sufficiently far apart to admit the body of the insect between them, while the wings are spread out and pinned on the tops. After being in this position for a few days the insects become hard, and may be transferred to the cases. Insect-pins should be used, as others are inconvenient. Grasshoppers, beetles, and crickets may be placed in the cases as soon as they are killed, unless it is desirable to preserve them with the wings spread. For butterflies, wasps, and the different kinds of dragon-flies, the setting-boxes are very necessary. If the insects become hardened before they can be placed in the setting-boxes, they may be softened by being placed on damp sand for a day or two. For collecting eggs, larvae, etc., boxes having small compartments may be used. Care should be taken that no two specimens of different kinds are placed together. The teacher should enter in a note-book the dates when specimens are brought in, the changes they undergo, and any particulars that are of interest in the work.

## Methods of Killing Specimens.

Different persons employ different means for killing specimens. Chloroform, ether, and ammonia are used by some, cyanide of potassium by others, while some recommend boiling water for beetles. Perhaps the most effective means for killing grasshoppers and beetles is immersion in alcohol, though the specimens must be removed as soon as they are dead, as, if allowed to remain long they will become brittle, and may lose their color. The specimens which the children are to handle may be kept in alcohol, however, as the brittleness does not matter, and the alcohol removes offensive odors. The teacher should have an abundance of specimens on hand, so that if one is destroyed it can be at once replaced.

Butterflies may be killed by turning the wings back and pressing the thorax near the head closely between the thumb and finger.

The insects given to the pupils for examination should each be fastened on a bit of cork or soft wood by a pin passing through the body. Every member of the class should have a specimen, and should be required to make his own observations. Each child should have a needle fixed in a short handle, for the purpose of moving the smaller parts. The class should also be provided with small knives and magnifying lenses. The lenses known as "linen triers" are the most convenient. Each child should have two blank-books, one for notes and one for drawings; a good drawing-pencil and eraser, and a pencil (or pen and ink would be better) for writing. If the writing is done with ink, good pens and blotting-paper may be added to the list of necessary articles. The teacher needs a set of shelves or a cabinet, where bottles containing specimens may be placed.

The most careful attention should be given to the cleanliness and neatness of the work, or else the natural interest will very soon be overcome by disgust. Specimens that are not kept in alcohol may be kept in glass or tin cases, carefully closed. Wooden boxes are, at any time, liable to be invaded by small insects in search of food.

One thing more should be in the school-room: a scrap-book, in which the teacher may paste prose items and bits of poetry cut from newspapers, and bearing upon the subject under consideration. The children should be invited to contribute to this scrap-book, and may thus be induced to read papers and books bearing upon the subject. Later, another book may be added, in which carefully copied facts may be inserted, together with items from the children, stating any discoveries they themselves have made, and carefully written descriptions of particular orders of insects.

I fear that some teachers may be deterred from attempting this work by a consideration of the details requiring attention. To such I can only say, that success in any direction is secured by close attention to details. The results in this work will more than repay the effort expended.

The order here presented is not by any means the best that can be given. It is one way of conducting lessons. If the teacher finds a better, by all means let him follow it.

In the study of the field cricket the *house* and *mole* cricket may be included; the teacher adding to the tabular view any items that may be necessary.

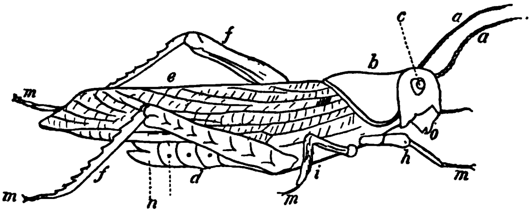
## LESSON I.

**OBJECT.**

To cultivate *Perception*, *Conception*, *Comparison*, *Reason*, *Judgment*, and *Language*. (*Spoken*, *Written*, and *Drawing*.)

**POINT.**

To develop idea of, and teach, *Size*, *Form*, *Surface*, *Color*, and *Principal Parts* of the grasshopper.




I. Locust.

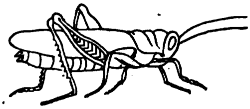
| | | | | | |
|---|---|---|---|---|---|
| *a a* | Antennæ. | *e* | Upper wings (folded). | *m m m m* | Tarsi. |
| *b* | Shield. | *f f* | Hind legs. | *n n* | Spiracles. |
| *c* | Compound eye. | *h* | Fore leg. | *o* | Mouth. |
| *d* | Abdomen. | *i* | Middle leg. | | |

**MATTER.**

1. *This grasshopper is about two inches long, and about half an inch in thickness, and one-fourth of an inch wide.*
2. *It has a body shaped something like a tube a little flattened, and tapers at one end.*
3. *It has a smooth surface.*
4. *Its color is light brown, dotted with dark brown spots.*
5. *It has three principal parts,—the head, thorax, and abdomen.*

**METHOD.**

*Teacher.* (Having presented specimens.) You may tell me the name of this little creature.



II. Small Field Grasshopper.

*Child.* It is a grasshopper. (Many of the children will give the name *hopper grass*.)

*T.* If you were going to describe it to a person who had never seen it, what would you mention first?

*Ch.* I should mention its size first. (Class decision. T. confirm.)

*T.* In order to get an idea of its size, how many dimensions must you consider.

*Ch.* We must consider length, width (or breadth), and thickness. (Class decision. T. confirm.)

*T.* What is the size of this grasshopper?

*Ch.* This grasshopper is about two inches long, about half an inch in thickness (measuring from back through), and about one-fourth (or perhaps a little less) of an inch wide (across the back).

Note.—In considering size, a class decision will be made not by guessing, or agreeing with some one who has guessed, but by actual measurement. Before measuring, however, the pupils should be allowed to judge of length in any direction.

*T.* What of the grasshopper will you describe besides the size?

*Ch.* We might describe the form. (Class decision. T. confirm.)

*T.* What is the form of this grasshopper?

*Ch.* If we look at the side it is somewhat oblong.

*T.* Who has another opinion?

*Ch.* It is nearly round.

*T.* What objection do you make to that?

*Ch.* It is not round. It has a body something like a tube.

*T.* (Shows tube.) How many think the form of its body is something like this?

*Ch.* It is like a tube that has been flattened a little.

*T.* What other difference do you observe?

*Ch.* It tapers at one end and the tube does not.

*T.* Now, who can describe the form of the body of the grasshopper?

*Ch.* It has a body something like a tube that has been a little flattened, and tapers at one end.

*T.* What shall we describe next?

*Ch.* We might describe the surface.

*T.* What sense have you used to find out what you have stated?

*Ch.* We have used the sense of sight.

*T.* What sense will you use to find what is true of the surface?

*Ch.* We shall use the sense of sight and touch. (Class decision. T. confirm.)

*T.* What kind of surface has the body of this grasshopper?

*Ch.* It has a smooth surface. (Class decision. T. confirm.)

*T.* What of the grasshopper shall we next describe?

*Ch.* We shall describe the color.

*T.* What color is this grasshopper?

*Ch.* It is brown. (Children object.)

*T.* What objection do you make to that statement?

*Ch.* It is not quite true.

*T.* What is true of it in regard to color?

*Ch.* It has two colors.

*T.* Very well, describe its colors.

*Ch.* It is brown, with nearly black spots.

*T.* How many think that statement is exactly true?

*Ch.* It is not quite true. The colors are not brown and black, but light brown and dark brown. (Class decision. T. confirm.)

*T.* You may make the statement in regard to color.

*Ch.* The body is light brown, dotted with dark brown spots. (Class decision. T. confirm.)

*T.* You have examined the grasshopper as a whole. What will you do next?

*Ch.* We shall study its parts.

*T.* With which part will you begin?

*Ch.* We might begin with the head.

*T.* How many see the head? (All do, and all touch it.)

*T.* What is the next part you see?

*Ch.* I see the body.

*T.* What part do you call the body?

*Ch.* I call the part next the head the body.

*T.* Begin just where the head joins the part you call the body, and trace it as far as it goes.

*Ch.* It goes to the tail.

*T.* That part between the head and tail is called the *thorax.* (Simultaneous recitation. T. write on board word *thorax.*)

*T.* Trace the length of the thorax and tell me what comes after it.

*Ch.* The tail comes after the thorax.

*T.* The part that comes next to the thorax is called the *abdomen.* (Simultaneous recitation. T. write on board word *abdomen.*)

*T.* Now you may show me the different parts you have found, and name them.

*Ch.* This is the head, this is the thorax, and this is the abdomen. (Several children make the same statement, until the teacher is certain that they all know the names for the parts.)

*T.* Look carefully, and find other parts of the grasshopper's body.

*Ch.* I see the eyes.

*Ch.* I see the horns.

*Ch.* I see the legs.

*Ch.* I see the wings.

*T.* Where are the eyes and horns?

*Ch.* They are on the head.

*T.* Then you will call them parts of what?

*Ch.* They are parts of the head. (Class decision. T. confirm.)

*T.* Now, where are the wings and legs?

*Ch.* They are on the thorax.

*T.* Then what may you call them of the thorax?

*Ch.* They are parts of the thorax.

*T.* You may call them attachments of the thorax. Now, how many parts of the body have you found?

*Ch.* We have found three parts of the body, and then we found parts of those parts. (Class decision. T. confirm.)

*T.* Which of these are the most important?

*Ch.* The head, thorax, and abdomen, are the most important. (Class decision. T. confirm.)

*T.* Since that is true, what parts may you call them?

*Ch.* We might call them the chief (or principal) parts.

*T.* Then make a statement in regard to the parts that compose the body of the grasshopper.

*Ch.* It has three principal parts, the head, thorax, and abdomen.

Drill, by having children describe the size, form, surface, and color, and by touching and naming the head, thorax, and abdomen. If the children are too young to write freely, the T. may write on the board the following table:—

GRASSHOPPER.

*Parts:* 1. Head.
2. Thorax.
3. Abdomen.

The children may copy this neatly in their books. If the pupils can write, the T. may write on board a series of questions covering the work that has been developed. The children will write the answers in their note-books. The questions for the lesson just developed would be about as follows:—

GRASSHOPPER.

1. What is the length of the grasshopper?
2. What is the thickness of the grasshopper?
3. What is the width of the grasshopper?
4. What is the form of the grasshopper?
5. Describe the surface of the grasshopper.
6. What color is the grasshopper?
7. Name the principal parts of the body.

While the pupils are writing, the T. attends to the use of capital letters, spelling, punctuation, and penmanship. This may be done by passing among the pupils while writing, or by calling attention for a minute to a

a sentence properly written on the board. About fifteen minutes should be given to writing, and then fifteen minutes may be devoted to drawing the grasshopper, the insects being placed in suitable positions on each child's desk, and not moved during the work. Great care should be given to leading the children to draw what he sees, and nothing more, the idea of truthfulness being prominent. The T. should be careful, that while drawing the children are not troubled by cross-lights from the windows. With very little trouble shades may be constructed to cover such windows as ought to be darkened during the drawing hour. As preparatory work for the next day, the T. may request the children to spend twenty minutes (or longer) in the field, or garden, observing insects and collecting for the cabinets. If out-door observation is not practicable, the pupils may be required to write five or six sentences each evening, giving an account of the work in school during the day. If this part of the work is carried on carefully, there will be no difficulty in getting the pupils to write compositions, as they are called. Each day's work will be a composition, and the young people will be as much accustomed to expressing their thoughts on paper, as to speaking. In this department do not have the pupils learn by rote anything upon the subject they are studying.

## LESSON II.

Review general description of the grasshopper, and parts, — head, thorax, and abdomen.

**OBJECT.**

To cultivate *Perception*, *Conception*, *Comparison*, *Reason*, *Judgment*, and *Language*.

**POINT.**

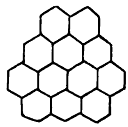
To develop idea of, and teach, *Size*, *Form*, *Surface*, and *Color* of the head, with parts, *eyes*, *antennæ*, and *mouth parts*.

**MATTER.**

1. *The head of this grasshopper is about half an inch long, vertically, and one-fourth of an inch thick, from side to side.*
2. *It is shaped something like a horse's head.*
3. *It has a smooth surface.*
4. *It is light-brown in color, dotted with small, dark-brown spots.*
5. *Attached to the head are two antennæ, two compound eyes, three small simple eyes (ocelli), and many mouth parts.*

**METHOD.**

*Teacher.* You may now examine the head of the grasshopper, and be careful to make your statements in regard to the specimens you have, as there are many other grasshoppers that you have not seen, that may differ from those you have seen.



III. Arrangement of cells of a compound eye.

*Child.* The head of this grasshopper is about half an inch long.

*T.* In what direction do you measure to get the length of the head?

*Ch.* Up and down.

*T.* Who can give a word that will tell us in what direction up and down is?

*Ch.* We measure vertically. (Class decision. T. confirm.)

*T.* In what other direction can we measure the head?

*Ch.* We may measure it horizontally.

*T.* And what of the head will that measurement give?

*Ch.* It will give the thickness.

*T.* You may make a statement in regard to the size of the head, including both measurements.

*Ch.* The head of this grasshopper is about half an inch long, vertically, and one-fourth of an inch thick, measuring horizontally. (Class decision. T. confirm.)

*T.* What is the next statement you are prepared to make in regard to the head?

*Ch.* I notice the shape, but I cannot describe it.

*T.* It is difficult to describe the shape. Perhaps you can think of some object you have seen, that the head resembles in shape.

*Ch.* (After several attempts.) It is shaped something like a horse's head. (Class decision. T. confirm. The T. will accept such a description for the present, as the form of the head is the most difficult part to describe, and the pupils have not many objects with which to compare.)

*T.* You may describe the surface.

*Ch.* It has a smooth surface. (Class decision. T. confirm.)

*T.* What is true of the color?

*Ch.* The color is nearly the same as that of the rest of the body.

*T.* What difference do you observe?

*Ch.* The dark brown spots are smaller than those on the body.

*T.* Now make a very careful statement in regard to the color of the head.

*Ch.* It is light brown, dotted with small, dark brown spots. (Class decision. T. confirm.)

*T.* What else do you notice?

*Ch.* I see two things on the head that are something like horns.

*T.* How many see these? (All do.)

*T.* Now make a very careful description of them, taking care to mention every point.

*Ch.* They are about one inch long. (Class decision. T. confirm.)

*T.* In what other direction may you measure them?

*Ch.* We might measure their size round, only they are so small.

*T.* Then what statement are you prepared to make in regard to their size?

*Ch.* They are long and slender. (Class decision. T. confirm.)

*T.* Continue the description.

*Ch.* They are shaped like a small tube. (Class decision. T. confirm.)

*T.* The next may speak of the surface.

*Ch.* They feel smooth.

*T.* Hold them up to the light and tell me what you observe.

*Ch.* They are made up of little rings all joined together. (Class decision. T. confirm.)

*T.* You may use the word *jointed* instead of joined, as that expresses the manner in which they are fastened together. We are ready for the next observation.

*Ch.* They are of a very dark brown color. (Class decision, T. confirm.)

*T.* You may describe their position.

*Ch.* They are on the upper part of the head.

*T.* Who can describe their position a little more accurately?

*Ch.* They are on the upper front part of the head. (Class decision. T. confirm.)

*T.* These are called the *antennæ* of the grasshopper. (Simultaneous recitation. T. write on board.)

*T.* Of what use are these antennæ?

*Ch.* The grasshopper feels with them.

*T.* Of what other use may they be? (Children do not know.)

*T.* It is supposed that they are organs of both feeling (touch) and smelling.

*T.* How many have seen the grasshopper move the antennæ? (Some of the children have, perhaps, observed this. If they have not, the teacher will call their attention to it, and have them watch the grasshopper in the field, and require them to give reasons for the different motions.)

*Ch.* When it jumps, the antennæ are pointed straight forward; when it is on the ground, the antennæ move upward or downward, or to either side.

*Ch.* I think whenever the grasshopper is disturbed it points the antennæ straight forward.

*T.* What else do you notice on the head besides the antennæ?

*Ch.* I see two eyes. (Class decision. T. confirm.)

*T.* Now you may describe those eyes very carefully, each making one statement.

*Ch.* They are about as large as the head of a pin.

*Ch.* They stand out from the head.

*Ch.* They are elliptical in form.

*Ch.* They are hard, smooth, and glossy (or polished).

*Ch.* They are of a dark brown color.

*T.* Describe their position.

*Ch.* They are just back of the antennæ.

*T.* Describe their position more carefully.

*Ch.* They are at the top of the front part of the head, one at each side. (Class decision. T. confirm.)

*T.* Why are they placed there? (Children cannot think.)

*T.* In how many directions can it see?

*Ch.* It can see in front, behind, and on each side, all at the same time. (Class decision. T. confirm.)

*T.* Then why are the eyes placed as they are?

*Ch.* They are placed there that the grasshopper may be able to see danger on all sides at the same time. (Class decision. T. confirm.)

*T.* These are *compound* eyes. They are made of many thousands of very small eyes called *facets*, which are fastened together in very much the same manner as the cells in a honeycomb. (T. illustrates by a drawing of small, hexagonal cells, joined together. These cells must be made as small as possible.)

*T.* Now look carefully at the part of the head near the eyes, and try to find something else.

*Ch.* I see something very small, just between the eyes and the antennæ, that looks like an eye.

*T.* How many see the same?

*Ch.* I think there are three, near together.

*T.* There are three very small eyes there, but it is very difficult to find them with the naked eye. They are called *ocelli*. (Simultaneous recitation. T. write on board word *ocelli*.)

NOTE. — Pupils have actually found the ocelli and called them eyes, but it is not usual for children to make such close observation as this discovery requires. If they do not find them, the teacher may tell them they are there.

*T.* Examine the head again, and find some other part.

*Ch.* We have not examined the mouth yet.

*T.* You may do so, each making a statement.

*Ch.* I can not describe the size of the mouth, except that it seems about one-fourth of an inch long, horizontally. (Class decision. T. confirm.)

*T.* Who can make another statement in regard to the mouth?

*Ch.* It is a little lighter brown than the rest of the head.

*Ch.* It seems rough.

*T.* What makes it rough?

*Ch.* Ever so many little parts stick out.

*T.* What may you call those little parts?

*Ch.* They are the mouth parts.

*T.* Without counting, how many mouth parts would you say the grasshopper has?

*Ch.* The grasshopper has many mouth parts. (Class decision. T. confirm.)

*T.* Now you may tell me, in the order in which you found them, all the parts attached to the head of the grasshopper.

*Ch.* Attached to the head of the grasshopper, are two antennæ, two compound eyes, three simple eyes (ocelli), and many mouth parts. (Simultaneous recitation.)

Drill, by having pupils describe head and parts, and giving names. Then write on the board questions covering the work, and allow the usual time for writing answers, taking care that the work be very neatly done.

QUESTIONS.

1. Describe the head of the grasshopper.
2. Describe the antennæ.
3. Describe the compound eyes.
4. Describe the ocelli.

After this, have the pupils draw the head, placing eyes, antennæ, and mouth parts in proper position. Be careful that pens and pencils are in proper condition, and that the work is neatly done.

## LESSON III.

Review description of the head of the grasshopper, as well as parts attached, having pupils give reasons for position of parts, and their uses.

**OBJECT.**

To cultivate *Perception*, *Conception*, *Comparison*, *Reason*, *Judgment*, and *Language*.

**POINT.**

To develop idea of, and teach, *Description*, *Uses*, and *Names* of mouth parts.

**MATTER.**

*The mouth parts of the grasshopper are:* —

1. *The labrum or upper lip.*
2. *The mandibles, a pair of large, strong jaws.*
3. *The maxillæ, a pair of jaws smaller than the mandibles.*
4. *The maxillary palpi, a pair of jointed feelers attached to the maxillæ.*
5. *The labium, or lower lip, composed of two small jaws fastened together.*
6. *Labial palpi, a pair of jointed feelers attached to the labium.*

**METHOD.**

*Teacher.* You may now examine the mouth parts closely, and describe the first part you find.

*Child.* I find a thin skin that lies on a hard surface.

*T.* Observe carefully where it is placed, and try to think what it may be.

*Ch.* It is something like an upper lip.

*T.* How many have found it? (All have.)

*T.* It is the upper lip of the grasshopper, and it is called the *labrum*. (Simultaneous recitation. T. write on board word *labrum*.)

*T.* Having found the upper lip, what would you naturally look for next?

*Ch.* I should look for the lower lip. (Class decision. T. confirm.)

*T.* Who can find it first?

*Ch.* I find something fastened to the chin; that may be it. (Have pupils find same.)

*T.* (Examining.) Yes, that is it. It is called the *labium*. (Simultaneous recitation. T. write on board word *labium*.)

Note.—T. may show that the labium is composed of two small jaws that seem to have grown together.

*T.* What parts have you already found?

*Ch.* We have found the labrum, or upper lip, and the labium, or lower lip, which is made up of two small jaws. (Class decision. T.. confirm.)

*T.* Look between the labrum and the labium, and describe what you find.

*Ch.* I find two hard things, one on each side of the mouth. (Class decision. T. confirm.)

*T.* Where are they in regard to the labrum?

*Ch.* They are close to the labrum. They seem to be just below the hard surface that the labrum covers. (Class decision. T. confirm.)

*T.* Those are called the *mandibles*. (Simultaneous recitation. T. write on board word *mandibles.*)

*T.* Who can think what they are for?

*Ch.* They are used when he eats. (Class decision. T. confirm.)

*T.* Then what will you call them?

*Ch.* They may be the grasshopper's jaws. (Class decision. T. confirm.)

*T.* Now describe the mandibles.

*Ch.* The mandibles are a pair of strong, hard jaws.

*T.* Look again at the mouth, and describe what you find.

*Ch.* I find two other things just below the mandibles, one on each side.

*T.* What do you think they are?

*Ch.* I think they are jaws, too.

*T.* Compare them with the mandibles in regard to size and hardness.

*Ch.* They are softer and smaller than the mandibles. (Class decision. T. confirm.)

*T.* They are called the *maxillæ*, or lower jaws. (Simultaneous recitation. T. write on board word *maxillæ.*)

*T.* Now you may name the mouth parts as far as you have found them.

*Ch.* We have found the labrum, or upper lip; the mandibles, a pair of large, strong jaws; the maxillæ, a pair of smaller jaws than the mandibles; and the labium, or lower lip, composed of two small jaws fastened together.

*T.* I should like you to find another difference between the maxillæ and the mandibles.

*Ch.* The maxillæ have little hairs fastened to them, and the mandibles have not. (Class decision. T. confirm.)

*T.* In what other place do you find those little hairs?

*Ch.* There are two on the labium. (Class decision. T. confirm.)

*T.* Those are called *palpi*. (Explain meaning of the word.) Now what do we need to distinguish the palpi on the maxillæ from those on the labium?

*Ch.* We need a name for those on the maxillæ, and a name for those on the labium. (Class decision. T. confirm.)

*T.* The palpi attached to the maxillæ are called *maxillary palpi,* while those attached to the labium are called the *labial palpi.* (Simultaneous recitation. T. write on board both terms.)

*T.* Now who can name all the mouth parts in the order in which they are placed, describing each as briefly as possible?

*Ch.* The mouth parts of the grasshopper are: —

1. The labrum, or upper lip.
2. The mandibles, a pair of large, strong jaws.
3. The maxillæ, a pair of smaller jaws than the mandibles.
4. The maxillary palpi, a pair of jointed feelers attached to the maxillæ.
5. The labium, or lower lip, composed of two small jaws fastened together.
6. The labial palpi, a pair of jointed feelers attached to the labium.

NOTE. — The T. will write the above sentences on the board, in the order in which they are given by the pupils, taking care to explain the difficult words, and having them use the technical terms after they have been learned, not allowing them to speak of the palpi as the feelers.

*T.* Now who can make a description of the mouth?

*Ch.* The mouth is quite small, and it is longer than it is wide.

*T.* Let another describe the mouth in some other respect.

*Ch.* It is rather hard, a little rough, and dark brown in color.

*T.* Where is it situated?

*Ch.* It is placed just at the lower end of the head.

*T.* Who has seen the grasshopper eat? (Several have.)

*T.* In what direction does it move its jaws when eating?

*Ch.* It moves its jaws out and in.

*T.* In what direction do boys and girls move their jaws while eating?

*Ch.* Boys and girls move their jaws up and down. (Class decision. T. confirm.)

*T.* What word may we use that would sound better than *up and down,* and mean the same?

*Ch.* Boys and girls move their jaws vertically.

*T.* In what direction does the grasshopper move its jaws?

*Ch.* The grasshopper moves its jaws horizontally. (Class decision. T. confirm.)

*T.* Who knows what the grasshopper eats?

*Ch.* He eats grass, grain, and leaves. (Class decision. T. confirm.)

*T.* Now let us consider whether those mouth parts are fitted to his needs. What is the use of the palpi?

*Ch.* Since they are feelers, it must use them to feel its food, to find whether it is of the right kind. (Class decision. T. confirm.)

*T.* Well, after selecting the food by means of the feelers, what part do you think he uses next?

*Ch.* I think he uses the mandibles next, to cut the grass into little pieces.

*T.* Why do you think that?

*Ch.* Because the mandibles are very strong, and the grass is tough. (Class decision. T. confirm, showing that this is why those organs are so strong.)

*T.* What does he do after cutting the grass?

*Ch.* I suppose he chews it.

*T.* How does he chew it? (Ch. may not know.)

*Ch.* Perhaps he uses the maxillæ for chewing his food. (Class decision. T. confirm.)

*T.* Now we have to consider the use of the labrum and labium. Of what use are they? (Children do not know.)

*T.* Of what use are your lips?

*Ch.* We look better with them.

*T.* Of what use are they in eating?

*Ch.* They cover the food and keep it from falling out of the mouth.

*T.* Now who can think of what use the labrum and labium may be?

*Ch.* They are for the same use as our own; to keep the food in the mouth.

*T.* In how many directions can the grasshopper move the labrum and labium?

NOTE.—If the children cannot tell this, the teacher had better not enlighten them, but have them watch the grasshoppers in the field, and find out.

Drill by having pupils find and name parts quickly; and, if possible, by having them draw some of the parts rapidly on the board. Then erase work from board, remove specimens, and have different children give a short and connected description of the mouth parts, after which assign the usual time for writing; and, to vary the exercise a little, the teacher need not write questions to be answered, but have them write a connected description of the parts studied. After writing, the usual time must be spent in drawing.

References will be made to the scrap-book, from time to time, and such items of prose or poetry read as bear upon the insect.

Have the out-door observations reported at least as often as once a week.

## LESSON IV.

Review *Description*, *Position*, *Motions*, and uses of *Mouth Parts* of the grasshopper.

**OBJECT.**

To cultivate *Perception*, *Conception*, *Comparison*, *Reason*, *Judgment*, and *Language*.

**POINT.**

To develop idea of, and teach, *Description*, and *Parts* of the *Thorax*, together with the *Parts* attached.

**MATTER.**

1. *The thorax is about half an inch long, horizontally, nearly half an inch vertically, and about one-quarter of an inch in thickness, from side to side.*
2. *Its shape is something like a tube somewhat flattened.*
3. *The surface is smooth, and rather soft.*
4. *The color is light brown, with dark brown spots over it.*
5. *The parts of the thorax are three rings, called the prothorax, the mesothorax, and the metathorax.*
6. *The parts attached to the thorax, are three pairs of legs, and two pairs of wings.*

**METHOD.**

*Teacher.* (After examining the head.) What part of the grasshopper do you think we may study?

*Child.* The thorax comes next to the head, perhaps we may study that.

*T.* In order to know the size of the thorax, how many dimensions must we consider?

*Ch.* We must consider the length, breadth, and thickness.

*T.* You may do so, carefully, and then describe the thorax, in regard to size.

*Ch.* The thorax is about half an inch long, half an inch wide, and one-quarter of an inch thick.

*T.* How many think that is true?

*Ch.* I do not know which direction he takes for length, and which for width.

*T.* You may try to improve upon what he has said of the size?

*Ch.* The thorax is about half an inch long, horizontally, nearly half an inch wide, vertically, and about one-quarter of an inch thick, from side to side. (Class decision. T. confirm.)

*T.* You may next describe the shape of the thorax.

*Ch.* Its shape is nearly round.

*T.* What objection do you make to that?

*Ch.* It is curved, but not round.

*T.* Who can think of something he has seen, that this resembles in shape?

*Ch.* It is shaped as if it had been round, and then flattened out.

*T.* Let some one else try.

*Ch.* Its shape is something like a flattened tube. (Class decision. T. confirm.)

*T.* You may next describe the surface.

*Ch.* I cannot see the surface of the thorax.

*T.* Why not?

*Ch.* It has so many things on it.

*T.* You may all remove those things; be very careful that you do not break any part, and put them aside for the present.

*Ch.* I can see the surface now; it is quite smooth, and not as hard as the head.

*T.* Make that description in as few words as possible.

*Ch.* The surface is smooth, and rather soft.

*T.* Who can describe the thorax, in regard to another point?

*Ch.* The color is light brown, dotted with dark brown spots. (Class decision. T. confirm.)

*T.* You may now speak of the parts of the thorax.

*Ch.* Shall we call the legs and wings, parts of the thorax?

*T.* Who has an opinion about that?

*Ch.* I think that we cannot call the legs and wings parts of the thorax, because they do not really help to make up the thorax: they are fastened to the thorax.

*T.* What word may we use, that will mean the same as *fastened to?*

*Ch.* We may say *attached to,* instead of *fastened.* (Class decision. T. confirm.)

*T.* Very well; now let us look for the parts which make up the thorax.

*Ch.* I think there are three parts.

*T.* What shall we call them, thinking of their shape?

*Ch.* They are not exactly round, or we might call them *rings.*

*T.* You may call them *rings* or *segments.* (Explain use of word *segment.*)

*Tr.* Now, we need names, to distinguish these segments from each other.

*Ch.* We might call them the first, second, and third rings.

*T.* What objection do you make to that?

*Ch.* We might not agree which is the first ring; one might say this one near the head, while another may say the one next the abdomen.

*T.* That difficulty is overcome by having a name for each ring. All find the ring next the head. That is called the *prothorax*. (Simultaneous recitation. T. write on board word *prothorax*.) Now touch the ring next the prothorax; that is the *mesothorax*. (Simultaneous recitation. T. write on board word *mesothorax*.) And the last ring is called the *metathorax*. (Simultaneous recitation. T. write on board word *metathorax*.)

Drill, for a minute, on the three words.

*T.* Now, you may state what you have learned about the parts of the thorax.

*Ch.* The parts of the thorax are three rings, the prothorax, the mesothorax, and the metathorax.

Drill, for a minute or two, upon the relative positions of these rings.

*T.* Who can tell me how these rings are fastened together? (Children do not know.)

*T.* How is the head fastened to the thorax?

*Ch.* It is fastened by a joint. (Class decision. T. confirm.)

*T.* The rings of the thorax are fastened (or jointed) together in the same way.

*Ch.* They seem to have a great many joints. The antennæ are jointed, the palpi are jointed to the jaws, and the rings of the thorax are jointed.

*T.* You will find still more joints as you study the little creatures farther. Now, you may tell me what you removed from the thorax, when you wanted to look at the surface.

*Ch.* I moved a queer little thing that looked like a collar.

*T.* Where was it placed?

*Ch.* It was placed over the upper side of the thorax, and covered the seam (or joint) that fastens the head to the thorax. (Class decision. T. confirm.)

*T.* Tell me whether it covered only the joint.

*Ch.* It covered more than the joint; it came down over the place where the wings are attached.

*T.* Of what use is it?

*Ch.* It keeps the place neat, and it is a protection.

*T.* What quality has it, that makes it a good protection?

*Ch.* It is hard.

*T.* Thinking of its use, who can make a name for this convenient little article?

*Ch.* (Suggests, cape, collar, shield.)

*T.* *Shield* is the best name, and you may call it so.

*T.* What, beside the shield, did you remove from the thorax?

*Ch.* I took off the wings.

*T.* How many wings did you remove?

*Ch.* We removed four wings (or two pairs). (Class decision. T. confirm.)

*T.* Where are those wings, in regard to one another?

*Ch.* (Examining other specimens.) One pair is over the other pair. (Class decision. T. confirm.)

*T.* Since this is true, how may you distinguish one pair from the other?

*Ch.* We may call them the upper and the under pairs.

*T.* Where are these wings fastened, in regard to the thorax?

*Ch.* They are fastened (or jointed) to the back of the thorax.

*T.* Who can be a little more exact?

*Ch.* The upper pair is fastened to the mesothorax, and the under pair to the metathorax. (Class decision. T. confirm.)

*T.* What, beside the wings and the shield, did you remove from the thorax?

*Ch.* We removed the legs.

*T.* How many legs has the grasshopper?

*Ch.* (Counting.) The grasshopper has six legs.

*T.* Where are the legs placed, in regard to the thorax?

*Ch.* They are arranged on the under side of the thorax, in two rows, three in each row. (Class decision. T. confirm.)

*T.* Tell, in another way, how they are arranged?

*Ch.* They are arranged in pairs.

*T.* To what parts of the thorax are they attached?

*Ch.* The pair next the head (the first, or front pair) is attached to the prothorax; the second pair to the mesothorax; and the third pair to the metathorax. (Class decision. T. confirm.)

Drill upon positions for a minute.

*T.* Make a statement in regard to the parts attached to the thorax.

*Ch.* The parts attached to the thorax are two pairs of wings and three pairs of legs. (Class decision. T. confirm.)

Drill by having children find and name parts of thorax, and the parts attached. Have them decide appearance and position of parts. Give the usual time to writing the reproduction, and the same time as before to drawing the parts studied.

NOTE. — The pupils will now begin to ask questions, and the T. will find it difficult to satisfy aroused curiosity. While he should study both insects and books, carefully, and come to the lesson full of the subject, it would not be well for him to answer the questions by *telling*, but he should put the children in the way of finding out what they want to know. Refer them to closer observation. Show them relations between parts. By showing them, I mean, *lead them to see*, encourage them to talk, and refer them to such books as they can use intelligently. Consult the scrap-books, the newspapers, where scientific items abound, and require reports of any knowledge, bearing upon the study, which the pupils may have gained. Let the work of collecting specimens go on vigorously.

## LESSON V.

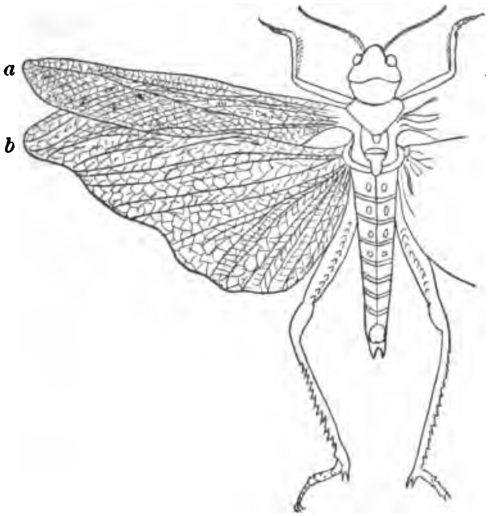
Review carefully the previous lesson.

**OBJECT.**

To cultivate *Perception, Conception, Comparison, Reason, Judgment,* and *Language.*

**POINT.**

To develop idea of, and teach, *Description, Position,* and *Uses* of the upper wings of the grasshopper.




II. Locust.

*a* Upper wing. *b* Lower or under wing.

**MATTER.**

1. *The upper wings of the grasshopper are about two inches long, and about half an inch wide.*
2. *They are very thin. They are long, flat, and nearly straight.*
3. *The surface is smooth and glossy.*
4. *They are soft in some places and hard in others.*
5. *They are light yellowish brown, with dark brown spots on the soft parts.*
6. *They are jointed to the upper sides of the mesothorax.*
7. *When in a position of rest, the upper edges fold over each other so as to form a kind of triangle along the back.*
8. *The uses of the upper wings are to aid in flying, and to protect the under wings.*

METHOD.

*Teacher*. In examining the upper wings I wish you to be very careful that nothing may escape your notice. You may first speak of the size.

*Child*. The upper wings are about two inches long, and about half an inch wide at the widest part. (Class decision. T. confirm.)

*T*. What in regard to size have you omitted to mention?

*Ch*. We have omitted to mention the thickness; but the wings are so thin that we cannot judge of their thickness. (Class decision. T. confirm.)

*T*. Then what statement will you make about them in this respect?

*Ch*. They are very thin.

*T*. Describe the shape of the upper wings.

*Ch*. They are long, flat, and nearly straight.

*T*. Why do you say *nearly* straight?

*Ch*. Because they are not quite straight, but curve a little at the end farthest from the body. (Class decision. T. confirm.)

*T*. You may speak of the surface of these wings.

*Ch*. They are smooth and glossy.

*T*. Use the sense of touch, and state what you observe.

*Ch*. They are soft in some places and hard in others. (Class decision. T. confirm.)

*T*. You may speak of the color.

*Ch*. They are light brown with dark brown spots. (Ch. objects.)

*T*. What objection do you make to that?

*Ch*. They are more like yellow than brown.

*T*. Then in what way can you modify what has been said about the color?

*Ch*. They are yellowish brown with dark brown spots.

*T*. Who wishes to modify that still further?

*Ch*. They are pale (or light) yellowish brown with dark brown spots.

*T*. Now I wish you to state anything that has not been mentioned about the upper wings.

*Ch*. At the upper end, where the wings join the thorax, they seem to be gathered together a little. (Class decision. T. confirm.)

*T*. Who can see any reason for that arrangement?

*Ch*. It makes the place at the joint smaller, and the ends fit more snugly under the shield.

*T*. Mention some other point.

*Ch*. The wings are thicker on one side than on the other. (Class decision. T. confirm.)

*T*. What causes that thickening?

*Ch.* It seems to be caused by a hard ridge near the outer edge of the wing.

*T.* Who can describe that ridge?

*Ch.* It seems to be made up of two or three rows of a bony substance.

*T.* Who can describe it more carefully?

*Ch.* It is rather horny than bony, and the ridge is made up, I think, of three threads that are near together near the upper end, and spread apart near the lower end.

*T.* Who else can describe this ridge more closely?

*Ch.* One of those threads runs along the lower edge, and when they get near the lower end of the wing, they all grow so small that we cannot feel them. (Class decision. T. confirm.)

NOTE. — T. will explain that these are veins, and will explain how they admit air and so help in flying; also show how the blood is aerated. If the pupils are very young, no mention need be made of this, but T. merely gives name, *veins*.

*T.* Mention anything else that you observe.

*Ch.* The wings are all full of little fine hairs or threads.

NOTE. — If the pupils are supplied with lenses, they may examine those small veins closely.

*T.* Those are small veins or veinlets. Now hold the wings between you and the light, and tell me what you observe?

*Ch.* The wings are clear.

*T.* What do you mean by that?

*Ch.* I can see through them.

*T.* How many can see through the upper wings?

*Ch.* We can see light through them, but cannot see objects very well. (Class decision. T. confirm, and give word *semi-transparent.*)

*T.* Now, you may mention anything else that you observe.

*Ch.* The dark brown spots are not on the large veins, but on the veinlets. (Class decision. T. confirm.)

*T.* Mention anything else you see.

*Ch.* The upper wings are longer than the body of the grasshopper. (Class decision. T. confirm.)

*T.* You may now describe their position.

*Ch.* They are fastened to the thorax.

*T.* To what part of the thorax are they attached?

*Ch.* They are attached to the mesothorax.

*T.* Who can be more particular in describing their position?

*Ch.* They are jointed to the upper side of the mesothorax. (Class decision. T. confirm.)

*T.* In how many ways does the grasshopper use his wings?

*Ch.* He uses them in two ways. He spreads them out when he flies, and he folds them straight along his sides when he rests. (Class decision. T. confirm, and explain meaning of word *Orthoptera: orthos* = straight, *pteron* = a wing.)

*T.* When the upper wings are folded how are they arranged in regard to each other?

*Ch.* (Examining.) They fold over each other.

*T.* I should like you to be very careful to make a statement that will exactly describe the arrangement.

*Ch.* When the grasshopper is at rest, the upper edges of these wings fold over each other and make a kind of flat place on the back.

*T.* Of what shape is that flat place?

*Ch.* It is a triangle. (Class decision. T. confirm.)

*T.* Now make a full statement in regard to the folding of the upper wings.

*Ch.* When in a position of rest, the upper edges of the upper wings fold over each other so as to form a kind of triangle along the back.

*T.* You may now consider the uses of the upper wings.

*Ch.* They aid in flying. (Class decision. T. confirm.)

*T.* Who can think of another way in which they are of use?

*Ch.* They cover the lower wings when the grasshopper is at rest.

*T.* And of what use is that?

*Ch.* They protect the lower wings.

*T.* Mention one quality which they have that fits them to protect the lower wings.

*Ch.* They are strong.

*T.* Mention another way in which they are a protection.

*Ch.* They are longer than the lower wings, and they keep their whole length and width, and so cover the lower wings completely.

*T.* Think of another way in which they are fitted as a protection for the whole body. (Children cannot think.)

*T.* You have seen one flying, and tried to catch it; when it lighted on the ground you could not find it, and in a moment it flew from your very feet. Why could you not find it when it was so near you?

*Ch.* I could not tell it from the ground.

*T.* Why not?

*Ch.* Because it looked like the ground.

*T.* What of it looked like the ground?

*Ch.* Its color was like the color of the ground. (Class decision. T. confirm.)

*T.* How many of you have seen grasshoppers that were not the color of the ground? (Children have probably seen green grasshoppers.)

*T.* Where did those green grasshoppers live?

*Ch.* They lived on trees or in green grass.

*T.* Now think why the green grasshoppers live among green leaves while the brown ones stay near the brown earth?

*Ch.* They do that so that other animals cannot catch them. (Class decision. T. confirm.)

*T.* Then of what use is the color?

*Ch.* It is a protection.

*T.* Yes. When we see an animal that has the same color as the objects around it, we say that it has *protective* color. Perhaps you can think of some animals that have protective color. (Children mention butterflies. T. leads them to think of many other creatures, and leads them to understand that domestic animals do not need this protection; consequently do not have it. Tells them that it is one of Nature's ways of preserving her creatures; and leads them to understand something of God's care over the least of his creatures.)

Drill by having pupils describe the upper wings, mentioning position and uses.

Assign the usual time for reproduction, and the usual time for drawing the upper wings.

## LESSON VI.

Review previous lesson carefully.

**OBJECT.**

To cultivate *Perception, Conception, Comparison, Reason, Judgment,* and *Language.*

**POINT.**

To develop idea of, and teach, *Description, Position,* and *Uses* of the under wings of the grasshopper.

**MATTER.**

1. *The under wings are about two inches long at the outer side, and one inch along the inner side.*
2. *When spread out, they are about two inches broad at the widest part.*
3. *They are very thin.*
4. *They are shaped something like a fan.*
5. *They are smooth and glossy.*
6. *They are of a pale yellow color.*
7. *They are attached to the upper side of the metathorax.*
8. *They are used in flying.*

**METHOD.**

*Teacher.* You may first speak of the size of the under wings. As soon as a pupil gives his opinion in regard to length, in any direction, you may measure.

NOTE. — Pupils should be provided with rulers one foot long, upon which they have marked inches. They will need to use them continually in their work.

*Child.* The under wings are about two inches long.

*T.* Who objects to that statement?

*Ch.* I think it is not exactly true. The wings are about two inches long at the outer side, but the inner side is only about one inch in length. (Class decision. T. confirm.)

*T.* You may speak of the width.

*Ch.* We can hardly tell how wide they are, they are so doubled up.

*Ch.* They are about two inches broad at the widest part. (Class decision. T. confirm.)

*T.* Where is the widest part?

*Ch.* It is near the outer end. At the end where the wings join the body, it is quite narrow, not half an inch wide. (Class decision. T. confirm.)

*T.* What other dimension will you mention, in connection with size?
*Ch.* We shall mention thickness.
*Ch.* We cannot give the thickness by measurement.
*T.* Then, what statement will you make?
*Ch.* They are very thin.
*T.* Speak of the form (shape).
*Ch.* The wing is shaped something like a fan.
*T.* What difference do you observe?
*Ch.* It is not shaped so much like a fan, but it folds as a fan does.
*T.* What difference do you observe between the shape of the wing and that of a fan?
*Ch.* The wing is longer at one side than at the other, while the two sides of the fan are of the same length.
*T.* Mention something else in connection with the form.
*Ch.* The wings are curved at the outer end, and the end which joins the thorax is drawn together. It is somewhat triangular.
*T.* Speak of the surface.
*Ch.* The surface is smooth and glossy.
*T.* Speak of some other point.
*Ch.* The wings are of a pale yellow color. (Class decision. T. confirm.)
*T.* Now, I should like each one to mention whatever he observes.
*Ch.* The wings are nearly transparent.
*Ch.* They have veins, as the upper wings have.
*T.* Compare these veins with those of the upper wings.
*Ch.* They are not so large, nor so hard. (Class decision. T. confirm.)
*T.* How do the large veins compare, in number, with those in the outer wings?
*Ch.* There are just as many in the under wings as in the upper. (Class decision. T. confirm.)

NOTE. — It would be well (with a view to future work) for the teacher to pay particular attention to the number of large veins in the wings (especially in the outer pair) of every insect studied. The typical number is five, and in different species the number varies. It is not necessary to give young pupils the names, costal, subcostal, median, submedian, and internal veins.

*T.* What else do you observe in connection with the large veins?
*Ch.* They all run the way of the greatest length of the wings. (T. gives the word *longitudinal*, and may again explain, that, like the veins of the upper wings, these veins are really double, having an air tube inside the tube through which the blood passes.)
*T.* Mention anything else you observe.

*Ch.* The small veins lie between the large veins, and seem to run in every direction. (T. give term *net-veined.*)

*T.* What else do you observe?

*Ch.* The folds of the under wings are longitudinal.

*T.* You may describe the position of the under wings.

*Ch.* They are attached to the upper side of the metathorax. (Class decision. T. confirm.)

*T.* Of what use are these wings?

*Ch.* They are used in flying.

*T.* Who has another statement to make in regard to these wings?

*Ch.* They are like a soft veil. (T. may give term *gossamer.*)

*T.* Why do you say they are like a gossamer veil?

*Ch.* Because they are so fine, and smooth, and soft.

*T.* Since they are so fine, and smooth, and soft, how may we say they are made?

*Ch.* They are very delicately made.

*T.* Of what advantage is this fine, delicate texture? (If children do not understand the word *texture,* the teacher will explain.)

*Ch.* They are very pretty.

*Ch.* They fold up nicely.

*Ch.* They take up very little space when folded, and are easily covered.

*Ch.* They have very little weight when the grasshopper flies.

*T.* When does the grasshopper fold them?

*Ch.* When it stops to feed.

*T.* What advantage is there in folding them so?

*Ch.* They have not protective color, and so are better out of sight when the grasshopper is at rest.

NOTE. — T. may show children other grasshoppers and locusts that have the under wings brightly colored, and lead them to understand the reason for bright colors in nature.

Review work upon both upper and under wings. If pupils are old enough, lead them to see that the wings are expansions of the outer crust spread over the horn-like framework of veins.

Spend the usual time upon the written reproduction, and the usual time upon the drawing.

## LESSON VII.

Review previous work.

**OBJECT.**

To cultivate *Perception*, *Conception*, *Comparison*, *Reason*, *Judgment*, and *Language*.

**POINT.**

To teach *Number*, *Description*, *Position*, and *Uses* of the legs.

**MATTER.**

1. *Attached to the thorax are three pairs of legs.*
2. *The front legs (first pair) are attached to the prothorax.*
3. *The middle legs (second pair) are attached to the mesothorax.*
4. *The hind legs (third pair) are attached to the metathorax.*
5. *The legs are of different sizes. The front legs are very slender; the middle legs are longer and thicker than the front legs; and the hind legs are very much larger in every way than either of the other pairs.*
6. *The surface is smooth and somewhat glossy.*
7. *The colors are light and dark brown, with little stripes of white on the hind legs.*
8. *The grasshopper uses the front legs as we do our hands, for grasping and holding things.*
9. *The middle legs seem to be used when the grasshopper is at rest.*
10. *The hind legs are used for hopping or jumping.*

**METHOD.**

*Teacher.* You may describe the legs of the grasshoppers you have in your hands, mentioning first anything you observe in regard to number and position.

*Child.* This grasshopper has six legs. (Class decision. T. confirm.)

*T.* How are they arranged?

*Ch.* They are arranged in pairs.

*T.* Then how many legs may you say it has?

*Ch.* It has three pairs of legs.

*T.* Where are the legs?

*Ch.* They are attached to the thorax.

*T.* Observe very carefully and find to what part of the thorax they are attached.

*Ch.* The two front legs are attached to the prothorax.

*Ch.* The two legs next to the two front legs are attached to the mesothorax.

*Ch.* The hind legs are attached to the metathorax.

*T.* Mention anything else that you observe.

*Ch.* The hind legs are very large.

*T.* Compare their size with that of the other legs.

*Ch.* The legs are of different sizes.

*T.* Speak of each pair, beginning with the smallest.

*Ch.* The two front legs are very slender.

*Ch.* The two middle legs are longer and thicker than the front legs.

*Ch.* The hind legs are larger in every way than either of the other pairs.

*T.* Speak of any other point.

*Ch.* They are smooth and glossy.

*T.* What objection do you make to that?

*Ch.* I think we cannot say they are smooth. I find on the lower part of the legs little sharp prickles on the surface.

*T.* Who else has observed those little prickles?

*Ch.* They are not all over the surface of the lower part of the legs. There are two rows of what seem to be little teeth on the outside of the leg.

*T.* Upon which legs are those teeth the largest?

*Ch.* They are largest on the hind legs. (Class decision. T. confirm.)

*T.* Who has another remark to make about those teeth?

*Ch.* I think they are on the outside of the lower part of the hind legs only. They seem to be along the inside of the other legs. (Class decision. T. confirm.)

*T.* Who has observed any other point?

*Ch.* I notice that the colors on the outside of the first four legs are nearly the same as those on the other parts. On the inside the colors are lighter. (Class decision. T. confirm.)

*T.* You may speak of the colors on the hind legs.

*Ch.* On the large parts of the hind legs the colors are arranged on the outside in little slanting rows that meet in the middle, and the light brown seems to have faded to white. (Class decision. T. confirm.)

*T.* Speak of anything else you observe.

*Ch.* Each leg has three joints.

*T.* Describe the joints.

*Ch.* The first joint is where the leg is fastened to the body; the second is where the upper part joins the lower part — it is like a knee-joint; and the third is where the lower part of the leg joins the foot.

NOTE. — Unless the pupils are somewhat advanced it would perhaps not be well to burden them at present with the names of the different parts of the leg. The name *tarsus* may, however, be given to the part they call the foot.

*T.* I wish you to examine the part you call the foot, and state what you observe.

*Ch.* The foot (tarsus) is made up of jointed pieces too. (Class decision. T. confirm.)

*T.* How many joints do you find in the tarsus?

*Ch.* The tarsus has four joints. (T. give plural of tarsus, *tarsi.*)

NOTE. — It is not at all probable that a whole class will at the same time have specimens with four-jointed tarsi, as they will not be able to distinguish between the grasshopper and the locust, and will doubtless have many of the latter, which have three-jointed tarsi.

*T.* You may mention anything else you observe about the tarsi.

*Ch.* The tarsi seem to have little teeth fastened to them as the legs have.

*T.* Who can think of the use of those little teeth?

*Ch.* They are to grasp and hold things with. (Class decision. T. confirm.)

*T.* Now you may continue your observation of the legs.

*Ch.* The front legs point forward. (Class decision. T. confirm.)

*T.* Who has observed the way in which the grasshopper uses the front legs?

*Ch.* It uses them to hold its food and to catch hold of things.

*T.* Who can think what part of the body boys and girls use for that purpose?

*Ch.* Boys and girls use their hands for that purpose.

*T.* Then what can you say of the way in which the grasshopper uses the front legs?

*Ch.* The grasshopper uses the front legs as we do our hands.

*T.* Of what use are the two middle legs?

*Ch.* They help him to hold on to things steadily when he is resting. (Class decision. T. confirm.)

*T.* You may now speak of the uses of the third pair of legs.

*Ch.* I think the grasshopper uses them in jumping or hopping.

*T.* Why do you think he uses them more than the others?

*Ch.* Because they are so large and strong. (Class decision. T. confirm.)

Drill by having pupils recall description, position, and uses of the legs, then give the usual time to reproduction and drawing of the parts studied.

## LESSON VIII.

Review previous work.

**OBJECT.**

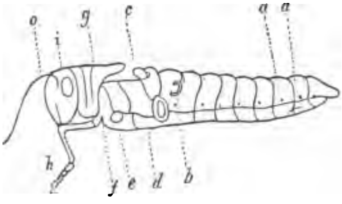
To cultivate *Perception, Conception, Comparison, Reason, Judgment,* and *Language.*

**POINT.**

To develop idea of, and teach, *Description, Position,* and *Uses* of the abdomen.

**MATTER.**

1. *The abdomen is about an inch and a half in length (horizontally), it measures half an inch (vertically) at the largest part, and about one-quarter of an inch in thickness (from side to side).*
2. *It is shaped something like a flattened (compressed) tube.*
3. *It is larger near the thorax than at the other end.*
4. *It is smooth, shiny, and rather soft (to the touch).*
5. *It has a sharp ridge along the back, and two ridges on the under side.*
6. *Its color along the back is dark brown.*
7. *The sides are light brown, with dark brown dots arranged vertically.*
8. *The under side is striped with yellow and brown.*
9. *The abdomen is composed of eight rings (segments).*
10. *The organs of hearing are placed on the ring of the abdomen nearest the thorax.*
11. *The spiracles are placed on the rings of the abdomen, one on each side of each ring.*
12. *The ovipositor is at the end of the abdomen.*




IV. GRASSHOPPER, WITH PARTS REMOVED.

*a a* Spiracles on segments.
*b* Tympanum.
*c* Wing attachments.
*d e f* Parts of thorax.
*g* Shield.
*h* Foreleg.
*i* Compound eye.
*o* Antenna.

**METHOD.**

*Teacher.* You may now begin to describe the abdomen of the grasshopper, taking care to keep the usual order.

*Child.* The abdomen is about an inch and a half long.

*T.* What objection do you make to that statement? (Ch. objects.)

*Ch.* I think he had better state the direction in which he measured.

*T.* He may do so.

*Ch.* It is about an inch and a half in length, horizontally. (Class decision. T. confirm.)

*Ch.* Its greatest vertical measurement is about half an inch.

*Ch.* It is about one-quarter of an inch thick, from side to side.

*T.* Who is ready to make the next statement?

*Ch.* I cannot tell the shape; it is not quite round.

*T.* Who can describe the form of the abdomen?

*Ch.* It is something like a tube that has been flattened. (T. leads Ch. to state that the abdomen is *compressed.*)

*T.* Mention anything else you observe.

*Ch.* The abdomen is larger at the part near the thorax than at the other end.

*T.* What else do you observe?

*Ch.* The surface is smooth and shiny.

*Ch.* It is quite soft to the touch.

*Ch.* It has a sharp ridge along the back.

*Ch.* There are two ridges on the under side.

*T.* You may speak of the color, and be very careful to omit nothing.

*Ch.* It is dark brown along the back.

*Ch.* The sides are light brown, with small, dark brown dots on them.

*Ch.* The under side is yellow and brown.

*T.* How are those colors arranged on the under side?

*Ch.* They are arranged in stripes. (Class decision. T. confirm.)

*T.* How is the abdomen made?

*Ch.* It is made up (composed) of rings. (Class decision. T. confirm.)

*T.* Of how many rings is the abdomen composed?

*Ch.* It is composed of eight rings. (Class decision. T. confirm.)

NOTE. — The T. may find the abdomen (in some specimens) composed of nine rings, and will be careful, here, that the children do not gain wrong impressions.

*T.* Now, I wish you to describe, carefully, everything you observe about the rings, each child mentioning one thing.

*Ch.* The rings are of different sizes. (Class decision. T. confirm.)

*T.* Who can describe them, in regard to this difference in size?

*Ch.* Each ring seems smaller than the one before it, so that one fits over the edge of another.

*Ch.* The largest ring of the abdomen is the one which is joined to the thorax.

*Ch.* The smallest one is out near the end.

*T.* Of what advantage is it for the rings to pass each over the edge of the other?

*Ch.* (May not know. If not, T. explain).

*T.* It enables the grasshopper to move the abdomen in any way. (T.

may here compare the motions of insects with those of animals differently constructed.)

*T.* We are ready, now, for further observations.

*Ch.* The dark brown spots are on the outer edge of each ring, just where it covers the one coming after it.

*T.* The ring which joins the thorax has none of these dots. (Class decision. T. confirm.)

*Ch.* The five rings nearest to that one have each ten dots, and the rest of the rings have only eight. (Class decision. T. confirm.)

*Ch.* The ring that joins the thorax has two queer things on it.

*T.* You may describe them.

*Ch.* They are two little round holes, one on each side. (Class decision. T. confirm.)

*T.* (Giving fresh specimens.) Examine these closely, and tell me whether you find those holes.

*Ch.* Yes, they are here, but they are covered over with a thin skin. (Class decision. T. confirm.)

*T.* These are the organs of hearing, and that thin skin has the same effect as the parchment stretched over a drum. This organ has the same name as that given to the drum of the human ear, — the *tympanum*. (Simultaneous recitation. T. write on board word *tympanum*, explain signification, and give plural.)

*T.* You may mention anything else you observe.

*Ch.* The rings on the under side of the abdomen do not fit, exactly, with those on the upper side.

*T.* You may state more fully what you observe in regard to them.

*Ch.* They are smaller on the under side.

*T.* What is the result of this difference in size?

*Ch.* Along the edges, where the upper rings meet the lower, there are two ridges extending horizontally.

*T.* Very well, what else do you observe in connection with the ridges?

*Ch.* On the edge of each ridge there are little dots. (Class decision. T. confirm.)

*T.* You may tell me anything you observe about these dots.

*Ch.* They are very small, not larger than the point of a pin.

*T.* How many dots are there?

*Ch.* There are two dots on each ring, one on each side. (Class decision. T. confirm.)

*T.* You may examine them under the glasses.

*Ch.* They seem to be little holes in the covering of the body. (Class decision. T. confirm.)

*T.* These little holes are called *spiracles*. You may describe their position carefully.

*Ch.* The spiracles are placed on rings of the abdomen, one on each side.

*T.* These spiracles are openings into a set of little tubes, as fine as the finest hairs, running all through the body of the grasshopper. These air-tubes are called *tracheæ.* (Simultaneous recitation. T. write on board word *tracheæ*, and explain singular form.)

*T.* Who can think of the use the tracheæ are to the grasshopper?

*Ch.* I should think the air would go into the body. (Class decision. T. confirm.)

*T.* Of what advantage is it to the grasshopper to have the air in its body in that way?

*Ch.* I suppose he needs the air to breathe.

*T.* How often are the spiracles open?

*Ch.* They are always open. (Class decision. T. confirm.)

*T.* Then, what kind of air has the grasshopper always in the body?

*Ch.* He has fresh air.

*T.* What does the fresh air do for him?

*Ch.* It makes him strong.

*T.* Who can think of something else the air does for the grasshopper?

*Ch.* It makes him light, so that he can fly easily. (Class decision. T. confirm.)

NOTE.—If the pupils cannot think of this, the teacher will explain, and refer to the birds as an illustration, showing that the bones are hollow, etc.

*T.* (Showing a living grasshopper under a glass.) What do you observe, in regard to the movement of this grasshopper?

*Ch.* The abdomen is moving.

*T.* Explain the movement as fully as possible.

*Ch.* The grasshopper seems to draw in the abdomen, and then to spread it out.

*T.* What is he doing?

*Ch.* He is taking in air. (Class decision. T. confirm.)

*T.* You may mention anything else that you observe, in connection with the abdomen.

*Ch.* I find something at the end of the abdomen that I cannot describe.

*T.* Who can describe it?

*Ch.* The upper and lower parts of the abdomen seem to have separated for a short distance, and each side has grown into two little hooks. (Class decision. T. confirm.)

*T.* Touch those little hooks, and state what you observe?

*Ch.* They are hard, and have quite sharp points. (Class decision. T. confirm, explaining the *ovipositor*, and the use that is made of the little hooks in digging holes in the ground in which to deposit eggs.)

The usual time will be given to writing the reproduction, and to drawing the abdomen, showing segments (rings), ridges, and spiracles.

## LESSON IX.

Review carefully previous work upon the grasshopper, from the beginning. Two or three of the regular recitations may be taken for this review. The time for written reproduction may be occupied in the students preparing carefully-written papers upon what they have studied; while the time for drawing each day should be spent in making well-finished drawings of different kinds of grasshoppers.

OBJECT.

To cultivate *Perception*, *Conception*, *Comparison*, *Reason*, *Judgment*, and *Language*.

POINT.

To develop idea of, and teach, *Kinds*, *Localities*, *Habits*, and *Uses* of grasshoppers.

NOTE.—In this lesson I shall omit the usual arrangement of matter at the beginning, as it will appear in the summary of the study of the grasshopper. The T. will, however, in preparing this part be very careful to have the usual arrangement of matter, as this is the most interesting part of the work.

METHOD.

*Teacher*. Since we began this work, how many kinds of grasshoppers have we examined?

*Child*. We have examined one kind. (Class decision. T. confirm.)

*T*. Who can tell whether there are other kinds?

*Ch*. There are other kinds, for we have caught them.

*T*. You may tell what you know about the other kinds.

*Ch*. The grasshoppers that live on trees are different from those we have studied.

*T*. Mention the differences.

*Ch*. They are green in color.

*T*. Why is that?

*Ch*. That is their protection. They are the same color as the leaves. (Class decision. T. confirm.)

*T*. In what other way do they differ?

*Ch*. The grasshoppers that live on trees are larger than the others.

*T*. Mention any other difference.

*Ch*. The green grasshoppers have more slender antennæ than the field grasshopper. (Class decision. T. confirm.)

NOTE. — The pupils may here confuse the locust with the grasshopper, and it will be well for the T. to have both insects, and have the children observe differences and learn to distinguish one from the other. The marked differences will be found to exist in the length of antennæ, the position of wings when at rest, the number of joints in the tarsi, the manner of flight, the habit of migration, etc.

*T.* Who can tell where grasshoppers are found?
*Ch.* We read of them in the Bible.
*T.* That proves that they were found long ago, where?
*Ch.* In Asia.

NOTE. — The T. may tell the pupils the different countries where these little creatures are known, and may read to them of the ravages of the locust in many different countries. He may tell them of the time of the coal-forests where grasshoppers and cockroaches abounded before the earth was fitted for the habitation of the higher animals. The pupils will probably be familiar with the accounts of the destruction caused by these insects in the West; and the teacher may introduce the talk upon locality by referring to them.

*T.* We shall now speak of the habits of the grasshopper. Each one may think of the things he has seen the grasshopper do, and let us see who has been the most careful observer.
*Ch.* The grasshopper jumps (hops).
*T.* Why does he not walk when he wishes to go from place to place?
*Ch.* His legs are so uneven he cannot. (Class decision. T. confirm.)
*T.* Very well. Now we are ready for another habit.
*Ch.* The grasshopper sings. (T. will have Ch. try to imitate the noise, — zic, zic, zic, — and then lead them to discover that this noise is made by drawing the back part of one of the hind legs across the large veins of the outside wing. Also tell them that it is the male grasshopper that makes the noise to call its mate.)
*T.* That singing noise is called *stridulation.* (Simultaneous recitation. T. write on board.)
*Ch.* When the grasshopper stridulates he uses only one leg.
*T.* How does he use it?
*Ch.* The motion is something like drawing a bow across the strings of a violin. (Class decision. T. confirm. Pupils will now perceive the use of the large teeth on the hind legs.)
*Ch.* I think some grasshoppers make another noise.
*T.* Yes, some do; and that noise is supposed to be made by the air rushing in and out of the spiracles and striking against a sharp edge which borders the spiracles.

*T.* Who has observed any other habit?

*Ch.* The grasshopper stridulates only in fine weather. (Class decision. T. confirm.)

*T.* About what time does the grasshopper appear?

*Ch.* He comes late in the summer.

*T.* How long does he stay?

*Ch.* He stays until cold weather.

*T.* What do you infer from that?

*Ch.* He is fond of warm weather.

*T.* When you have watched him in the field, what have you observed in regard to his fondness for warmth?

*Ch.* We saw him sitting in the sun. (Class decision. T. confirm.)

*T.* How many have seen grasshoppers in the shade?

*Ch.* We have seen them in the shade, but they stay longer in the sunlight.

*T.* On what kind of land have you found the greatest number of grasshoppers?

*Ch.* On high land. (Class decision. T. confirm.)

*T.* What is true of high land in regard to moisture compared with low land?

*Ch.* The high land is dry, and the low is not.

*T.* Then what places do the grasshoppers frequent?

*Ch.* They frequent dry places. (Class decision. T. confirm.)

*T.* We are now ready for other statements.

*Ch.* They eat a great deal. (T. here refers to the destruction of crops by the locust.)

*T.* What else can you say of them?

*Ch.* They eat vegetables.

*Ch.* They chew (grind) their food.

*Ch.* They make a noise at night. (Nearly every child will know that the tree grasshopper does this. If not, the T. will tell them.)

*T.* You may tell where they live.

*Ch.* The large green grasshoppers live in trees; the small grasshoppers frequent meadows and fields. (Class decision. T. confirm.)

*Ch.* They lay their eggs in the ground. (T. will tell pupils that the true grasshopper does this, and refer them to the use of the ovipositor. But the locust does not take such good care of its eggs; it deposits them in the ground without making a hole. May also tell them the habit the green grasshoppers have of leaving the trees at night and betaking themselves to the meadows and fields.

*T.* Who can think of another habit?

*Ch.* They use their fore legs as we do our hands. (Class decision. T. confirm.)

*T.* You may speak of their manner of flying.

Note. — If the children have not perceived the short, uncertain flight of the grasshopper, the T. may explain; also lead them to state that the *locusts* make long journeys from place to place, moving in crowds.)

*T.* Now, if you have mentioned all the habits of the grasshoppers and locusts, we shall consider of what use they are in the world.

*Ch.* They are not of any use.

*T.* Who knows whether that is true?

*Ch.* They are food for birds. (Class decision. T. confirm.) T. may lead children to see that they destroy weeds and much offensive matter; may refer to the use the wasp makes of them; and, if they do not know, tell them that grasshoppers and locusts were (and are) used by the people of the East for food. They are eaten with honey and oil, and are considered very delicious. (T. *may here explain partial metamorphosis.*)

## SUMMARY OF WORK.

### *The Grasshopper.*

- I. Parts
  - Head
    - 1. Description.
    - 2. Parts
      - Eyes,—two, compound, facets, elliptical, hard, smooth, glossy, brown.
      - Antennæ,—two, long, slender, round, dark brown, in front of eyes.
      - Mouth parts
        - Labrum.
        - Mandibles.
        - Maxillæ.
        - Labium.
        - Maxillary palpi.
        - Labial palpi.
  - Thorax
    - 1. Description.
    - 2. Parts
      - Three segments, irregular in form,—prothorax, mesothorax, metathorax.
      - Attachments
        - Three pairs of legs and two pairs of wings.
        - Shield covering the shoulders.
  - Abdomen
    - 1. Description.
    - 2. Parts
      - Eight or more *articulated* (jointed) segments, bearing apparatus on first segment.
      - Spiracles,—two on each segment, ovipositor.
- II. Geographical Distribution
  - Throughout the United States.
  - In Europe.
  - In Asia.
  - In Africa.
  - (Mention countries where the locust has been especially destructive.)
- III. Habits
  1. Stridulation (in dry weather).
  2. Hopping *or* jumping.
  3. Deposit eggs in the earth.
  4. Partial metamorphosis.
  5. Live in meadows.
  6. Green grasshoppers live in trees.
  7. Vegetable feeders.
  8. Cut and grind food.
  9. *Locusts* move in crowds, and are migratory.
  10. Grasshoppers' flight unsteady.
  11. Frequents dry land.
  12. Sits in the sun.
  13. They eat enormously.
  14. Use the forelegs for holding food.
  15. Three stages of existence
      - 1. The egg.
      - 2. The insect without wings.
      - 3. The perfect insect.

IV. USES .
1. They destroy weeds and other offensive matter.
2. They are food for domestic and wild fowl.
3. They are used as food by some people.

NOTE. — If other uses are known, they may be added here. Indeed, any part of the lessons may be greatly improved by adding more knowledge, if the teacher possesses it. If he continues to study and teach, he will have thousands of ways of extending his information. Nothing has been done with the nervous system, nor the digestive apparatus of this insect, as the pupils will not be able for some time to take up work involving such close observation. Circulation may be touched upon when studying the veining of the wings.

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## SUMMARY OF LESSONS ON THE FIELD CRICKET.

### *The Field Cricket.*

- A. PARTS
  - I. Head
    - 1. Description (size, form, surface, qualities, color, position, motions).
    - 2. Parts
      - 1. Eyes (number, size, structure, form, surface, qualities, color, use, position).
      - 2. Antennæ (number, size, form, surface, structure, qualities, color, uses, position, motions).
      - 3. Mouth parts (number, size, form, surface, structure, color, motions, qualities, uses, positions, names).
  - II. Thorax
    - 1. Description (size, form, surface, qualities, color, position).
    - 2. Parts
      - Segments (number, size, form, surface, structure, qualities, color, position).
    - 3. Attachments
      - 1. Wings (number, size, form, surface, structure, qualities, color, uses, positions, peculiarities of *veining*, motions).
      - 2. Legs (number, size, form, surface, structure, qualities, color, uses, position, motions).
  - III. Abdomen
    - 1. Description (size, form, surface, structure, qualities, color, position, motions).
    - 2. Parts
      - 1. Segments (number, size, form, surface, structure, qualities, color, position, motions).
      - 2. Stylets (number, size, form, surface, structure, qualities, color, uses, position).
      - 3. Ovipositor (description, uses).
      - 4. Spiracles (number, form, color, uses, position).

| | |
|---|---|
| B. GEOGRAPHICAL DISTRIBUTION | They are found throughout the United States.<br>Found also in Europe and Asia.<br>In the West Indies a species exists which destroys the sugar-cane. |
| C. HABITS . . | 1. Partial metamorphosis.<br>2. The female lays about three hundred eggs in a mass.<br>3. The pupæ are wingless, and remain torpid in the ground during the winter.<br>4. They jump or leap as the grasshopper does, but they fly very rarely, and for short distances.<br>5. Nocturnal, and somewhat solitary.<br>6. Young live peaceably, but older ones fight.<br>7. They are very shy.<br>8. Seldom comes out in the daytime unless disturbed. (May be brought out by letting down a straw into its hole; the cricket clings to it, and is drawn out.)<br>9. Vegetable and animal feeders.<br>10. They drink dew on flowers.<br>11. Do not like to get wet.<br>12. Have holes in the earth.<br>13. Shrilling (by male rubbing wings together to attract the female).<br>14. Eat voraciously. |
| D. USES . . | They destroy other insects and offensive matter. |

# II.

# QUINCY SCHOOL WORK.

# QUINCY SCHOOL WORK.

## INTRODUCTION.

WHILE it is claimed by Supt. Parker and others that there is nothing *new* in his methods, no *new* system, — simply carrying out in a *rational* way the fundamental principles of mental training as practised by the scholars and teacher in centuries past, — yet it cannot be gainsaid that, if the teachers of America have known the methods used in Quincy, it is a sad reflection upon them that they have not attained better results in teaching the essential subjects.

The author of the "School-Room Guide" makes this admission to the public, — that, after studying the best methods and systems of education for twenty-five years, he saw many *new* methods of teaching in the Quincy schools; that he has from time to time made application of the methods, and through persistent application has attained the best results.

In the first publication of the "School-Room Guide," in 1874, I set forth many of the methods used by the teachers in the Quincy schools. On my visit to the schools, I found that the teachers had *mastered* the methods, and many others that I had never discovered.

It is only just to say that the teachers under Supt. Parker's supervision have surpassed others in the application of methods. In every exercise that I saw, it seemed to be the *rational* method of teaching *naturally* applied.

For the benefit of teachers throughout the nation, and through the permission of Supt. Parker, I will report what I saw in the Quincy schools, what I heard at "Martha's Vineyard Summer Institute," in the year 1881, and what I have gained by conference and reading. Personally, I wish to acknowledge my gratitude to Supt. Parker, for I have been strengthened through his intelligent direction in school work.

Too much praise cannot be given to Supt. Parker for the work he did in Quincy. He has *fixed* principles of action, and has proven beyond a doubt that they can be vigorously and practically applied in school work. His aim was to get primary teachers out of "*the rut*," and give to the people a higher and better order of work in the primary departments in graded and ungraded schools.

That he has accomplished this, thousands of the best teachers throughout the country will testify. His manner of teaching has revolutionized primary work in more than one-half of the schools in the United States.

The following Report from Prof. Hermann B. Boisen, late of Williams College, bears on this surject. It was published in the "Boston Transcript" of Oct. 26, 1881:—

The charge of laxity with regard to the Quincy schools is certainly not new. I have heard the Quincy work discussed frequently and for years, both in the East and in the West, and almost invariably by two sorts of people. Some denied to it all originality, and claimed that the so-called "Quincy methods" were really and properly their own; while the others denied to it all merit, criticised severely the resulting laxity of discipline and work. But few of them, as I discovered to-day, had more than a very vague idea of what was really done in Quincy itself.

Desirous to know what I ought to do, — whether to scorn with those scorning Quincy pretensions, or to frown with those frowning with Quincy laxity, — I went this morning to examine for myself.

Now I undoubtedly saw a new state of things, and breathed a new atmosphere. Aside from the question whether the discipline be lax and the influence upon American youth be disastrous or not, — be that as it may, — if there are really other communities and other school systems accomplishing similar results with similar methods, and with the same unity of work and aim, then I certainly have failed to discover them, and that in spite of the most diligent search. And yet I have taken special pains to visit the schools of those principals who claimed the Quincy method *par excellence*, and I found some that really had the Quincy machinery, but they had left behind the motive power; and I found others that had the Quincy liberty, but without the Quincy law; while those who were the loudest in their pretensions had usually neither the one nor the other.

Col. Parker was a teacher before the war, and retiring from the army at the close of the war, resumed his early occupation. He taught in the East and in the West, in Illinois and Ohio, but he was not satisfied with the prevailing methods of instruction. In a word, he taught until he became convinced that he was not teaching in the right way. Then he abandoned the profession of a teacher, and became a pupil. He spent three years of his mature life as a student in the universities of Germany. He went to Germany under a strong impression that there ought to be a science of teaching; he returned thoroughly convinced that the germs of such a science had long ago been discovered by Rousseau, and applied, in a measure, by Pestalozzi and Frœbel, and other educators of Europe. What is more, Col. Parker returned with the modest conviction that he had mastered, to a degree, the science of teaching. Of this fact he was able to convince the Hon. Charles Francis Adams, Jr., who was already

thoroughly imbued with a sense of the radical deficiencies of the existing system, and this led to a trial of the Quincy experiment under very favorable conditions.

The Hon. John Quincy Adams, in the school report for 1880–81, thus gives the result of Col. Parker's superintendency:—

"For five years the town had the benefit of his faithful, intelligent, and enthusiastic services. In those years he transformed our public schools. He found them machines, he left them living organizations; drill gave way to growth, and the weary prison became a pleasure-house. He breathed life, growth, and happiness into our school-rooms. Year by year, as the change went on, the gradual process of transition was reported to the town, and year by year the town, by great majorities, approved the work, and sustained its author. The committee have never doubted that he wrought a great gain to education among us, and that our schools have been vastly bettered by the methods he introduced, the organization he effected, and the enthusiasm he instilled."

After five years in Quincy, Col. Parker accepted the superintendency of the primary schools of Boston. He was called from the Boston schools to the Cook County Normal School, Englewood, Illinois, where he is to-day engrafting his reformed methods of teaching.

*Extract from the Pennsylvania School Journal.*

"The 300,000 teachers of this country are as faithful, honest, and earnest as any other class of active workers. If, then, these great truths in education be at the doors of our educators, why do they not acquire and use them? The answer is not far to seek. Not one teacher in 500 ever makes a practical, thorough study of the history of education, to say nothing of the science. Thought expressed concretely in inventions and machinery has changed.

"Is it not reasonable to suppose that the application of this science, which has for its purpose the development of thought, would make changes far broader and better for the world's good than the application of steam or electricity? The tremendous projecting power of tradition stands stubbornly in the way of progress in education. It can only be met and overcome by the most thorough, searching, and indefatigable study of the child's nature, and of the means by which the possibilities for good in God's greatest creation may be realized.

"This exposition of the new, and yet old, science of teaching is brief and necessarily incomplete — a bird's eye view — but it is sufficient to show that the true method of teaching according to Col. Parker differs radically, fundamentally, from the method now in use by 300,000 teachers in the United States; and in considering this fact, — the magnitude of the

fraternity of teachers now imparting instruction in the old routine way,—the proposed work of reform is assuming an almost appalling aspect. For Col. Parker well remarks, inferentially, that no teacher is properly equipped for the practice of his profession until he has mastered both the history and science of education. This fact alone shows the exacting nature of the teacher's profession under the new *regime*. But it is not alone in the matter of preparation that the profession is exacting. The new system of teaching destroys the old machine, but it does not put a new machine in its place. As Mr. Adams, already quoted, says: 'Col. Parker found our schools machines; he left them living organisms.' Now, where there is real intellectual life, there is luxuriant intellectual growth. The child's mind expands under scientific training as naturally and as rapidly as plants develop under the genial influence of light, heat, moisture, and air. But there is no rest for the husbandman through the early stages of the growth of the plant. Almost incessant cultivation is an essential requisite to a full harvest. So of the child under the new *regime*. He is not crammed from books, so much to-day and so much to-morrow, but he is stimulated to think instead of being thrown into a comatose state by abstractions. He is shown, for instance, in number, not that two and two make four merely, but that two and two things make four things. When he is shown a sign he is also shown the object of the sign. This method causes the child's mind to put forth thoughts as the plant puts forth leaves; and every fresh thought enlarges the sphere of observation, bringing the child into new relations with the universe of things. At each new discovery his face lights up with pleasure. He makes comparisons, draws conclusions, asks questions, makes startling philosophic observations. In a word, he becomes an inquirer after truth. This is the explanation of Mr. Adams's remark of Col. Parker,—'He breathed life, growth, and happiness into our school-rooms. He found our schools machines; he left them living organisms.'"

## Explanatory Remarks.

I visited the schools of Quincy in the year 1880,—then under the supervision of Supt. Francis W. Parker,—and carefully observed the work.

Before entering the school, I had a talk with Supt. Parker across the breakfast-table of an hour, upon his work in Quincy, and there I found out his secret of success.

Supt. Parker had studied the history and the science of education, and had come nearer to a *mastery* of them than any other educator or teacher in this country. He had *positive, fixed* principles of action, and had settled upon his way of doing the work.

After talking with him, I was not so much surprised in witnessing the

best work that I had ever seen in the primary departments, in Reading, Spelling, Language, Penmanship, Number, Geography, and History.

I was so well pleased with what I had observed in the Quincy schools, that in the year 1881 I attended the first "Martha's Vineyard Summer Institute," and became a pupil under his instruction. Through the kindness of Wm. J. Slattery, principal of a public school in Paterson, N. J., I have obtained full notes of the work done by Supt. Parker at the "Martha's Vineyard Summer Institute," of 1882. I would also state that Mr. Kellogg, editor of the "New York School Journal," kindly permitted me to examine his file of papers, and use any items of the "Quincy Work."

The work has been classified, and the questions and the answers so arranged as to form a Compendium on Teaching.

Great pains have been taken to obtain Supt. Parker's crystallized statements of his work in the Quincy schools.

Let the reader imagine Supt. Parker standing before a body of *earnest, anxious* teachers, who are eager to obtain light upon teaching.

# QUESTIONS AND ANSWERS RELATING TO THE SCIENCE AND ART OF TEACHING.

*Question.* Can the new system have a fair trial in the hands of the old *regime* of teachers?

*Answer.* If there is a science of teaching, it must be understood before it can be imparted to the pupil, and if this science involves the use of a radically different method from that now followed, it is idle to assume that the new system can have a fair trial in the hands of the old *regime* of teachers. For they must not only acquire an almost entirely new science, but must unlearn everything inconsistent with it, in the old system; and this in the midst of the daily performance of duties requiring an undivided attention. The fundamentals of a science are not to be acquired in this way. Studying a science while in the constant practice of violating its fundamental principles produces inextricable confusion in the mind of the student. The old errors are not thoroughly eradicated, and the new truths fail to secure a firm lodgment.

Q. Is there a science of teaching? And if so, what are its principles, and what are the methods of its professors? In a word, what is the difference between the old method of teaching and the new?

A. The true ideal of education is the harmonious development of all the powers of the body, mind, and soul, or, in other words, the purpose of all those who have to do with children should be to make out of them the very best possible men and women. This consists of nothing short of the realization of all the possibilities for growth that lie latent in the mind of the little child. How this may best be done is the great problem for all educators. On the one hand, we have the mind and its powers to be developed; on the other, we must seek for means of development. Now it would seem that the more the teacher knows of the mind, its faculties, laws of growth, and limitations, the better he can apply the means of development. It is not claimed that all the powers and laws of the mind have yet been discovered. But it is well known that there is a substantial agreement on the part of all psychologists concerning the main laws of thought and its development. Calderwood says: "As to the laws of observation, of association, of reason, of pleasurable feeling, there is all but perfect agreement among them." The science of education consists of a synthetic and systematic arrangement of these known laws in such a way that they may be best applied to mental growth. That is, the teacher who comprehends the science of education need not violate one of these laws in his instruction of children.

The discussion of what these laws are is by no means a new one. It has extended throughout several centuries, and he who studies the history of education will find that Bacon, Locke, Comenius, Rousseau, Pestalozzi, Frœbel, Spencer, and Mann have shown how mind can be developed, and the true ways of acquiring knowledge. Although no one of these great thinkers has presented a full science of education, and although they have differed in matters of detail, yet, in fundamental principles, they are substantially a unit.

Q. To one who is anxious to know more of the science of education, what is necessary?

A. The most important work of to-day is to collect, reconcile, and apply all the principles and methods of education that have been discovered in the past into one science and art of teaching. This would certainly radically change all our school work in this country. When this is done, the ground will be made ready for new advances in the incomplete science of education. Because a complete science has not yet been discovered is a very poor reason for not applying what we already know. What specific changes would the application of known mental laws in teaching, about which all psychologists are in agreement, bring about? For it is only by a sharp comparison of what is now done according to tradition and custom in our schools, with that which can be done by the application of the simplest principles of teaching, that the value of the true art of instruction may be in some degree appreciated.

Q. What must be done in order to inspire and develop the realities of thought? Is it possible to do things by doing something else?

A. To illustrate this, it may be mentioned that little children have been taught to read in the past, and a great majority of them are now taught, by a method that is utterly opposed to a mental law about which there can be no dispute among those who know anything of the science of teaching. I refer to the miserable A-B-C method. Nearly 300 years ago, Comenius discovered a rule of teaching which may be said to embrace all the rules in its category: "*Things that have to be done should be learned by doing them.*" This rule is so simple and plain that every one except the teachers has adopted and used it since man has lived upon the earth. If I am not very much mistaken, the schoolmaster for the last fifty years has been incessantly inventing ways of doing things in the school-room by doing something else. We try to teach the English language by rules, definitions, analysis, diagrams, and parsing; before the poor, innocent child can write a single sentence correctly, we teach the painful pronunciation of words without the grasping of thought or reading. We vainly endeavor to give children a knowledge of number, by teaching figures, the signs of number. We cram our victim's mind full of empty, meaningless words instead of inspiring and developing them by the sweet and strong

realities of thought. This futile struggle to do things by doing something else is to-day costing the people of this country millions and millions of hard-earned dollars; and it is much to be feared that it will one day cost their children the blessings of a free government. This is a serious charge.

Q. What is education?

A. Education is not training; it is self-development.

Q. What is the best way of acquiring a science?

A. The study of a science is the best way of acquiring a science.

Q. Some teachers use a device in teaching. Do you call a device a method?

A. A device is not a method.

Q. What is skill in the teacher?

A. Facile and ingenious expression of knowledge.

Q. What is method?

A. Natural, true method is the perfect adaptation of this expression to the mind. This is method in all its length, depth, and breadth.

Q. What is teaching?

A. Teaching is the harmonious development of the human mind.

Q. What is necessary before we can develop the human mind?

A. We must know what the mind is before we can develop it.

Q. How can this be done?

A. By teaching experimentally, and watching its action.

Q. What is meant by skill in the teacher?

A. It is the means of knowing the nature and power of the thought in the mind of the child. The pupil must get thought himself. The value of the mental action is the power acquired in the getting of the thought. Mental growth is education.

Q. Where does the child get his idea?

A. From the external world.

Q. What is the best means of getting a language?

A. The study of a science is the best means of getting a language.

Q. What is the teaching of language?

A. The teaching of language is the development of thought. Skill, or manifestation, is the means of watching thought. The form of the thought secondary, but important. Thought-training and expression go hand in hand; the expression measures the power of thought.

Q. What is the foundation of education?

A. Training the senses is the foundation of education, and it has also much to do with the superstructure. The practical value of close, accurate observation cannot be overestimated.

Q. What is teaching?

A. Teaching is defined as leading the mind out and up to the power of grasping thought and comprehending knowledge; and the best teach-

ing is that which develops all the faculties harmoniously, — the senses, reason, imagination, will, etc. A great difference between the work done here and that to which we are accustomed is this: The principal work of Quincy teachers is teaching. The great mass of teachers *train* but do not *teach*. Subjects must be taught without regard to pages of text-books until they become a part of the child's mind; that, in teaching, words play a minor though an important part, being the servants, not the masters. The senses are trained by proper exercise; original observation and investigation are stimulated, thus leading up to thought and reasoning. They try to keep ever in view the fact that the mind grows entirely by its own activities; that explanations and lectures not assimilated by pupils are fully as bad as the old text-book methods. Some of the most valuable results of the "New Departure" are seen in the increased capability of children for work, — the formations of habits of systematic work, — the real love of the children for work, — the increased capability of children, as they leave school, to master whatever trade, profession, or business they may enter upon.

Q. You speak of device in teaching. What do you mean?

A. Device is a bending of method to the individual condition.

Q. How would you seek to develop character?

A. Character is formed by habits; habits by repetition of actions. Bad habits are cured by doing the right thing over and over again. Character is a growth, a very slow growth; it is formed of every deed, thought, and word.

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## READING.

### First Work in School.

*Question.* What is the first work to be done with a child in school?

*Answer.* The fundamental idea is the application of Nature's method in teaching children. Hagel says that "the average child of six years has learned as much as he will learn during the remainder of his life." The first work in the school is to make the child feel at home; to overcome his natural timidity and shyness, and let him get acquainted with his schoolmates. If left to themselves, in less than fifteen minutes they will become familiar friends. Now begin to quicken the senses, and to stimulate the perceptions; or, in other words, to enlarge the ability to receive information. Every fact that he knows has made its way to the brain through the avenue of the senses.

Q. We would like to know *how* to begin to teach the children to read.

A. As I have before stated, the first effort of the teacher is to break

down all barriers of restraint and timidity between the teacher and the children, and in so doing engage them in conversation upon some object with which they are perfectly familiar, never allowing the language of the teacher to get beyond the children's vocabulary, — thus leading them along step by step until the children feel perfectly at home. In such a conversation the talk may be about a hen, and the teacher while talking has gone to the board and commenced drawing the picture of a hen, leading the conversation to the different parts of the hen as she draws it. Remember this: —

> "Sounds which address the ear are lost and die
> In one short hour; but that which strikes the eye
> Lives long upon the mind; the faithful sight
> Engraves the knowledge with a beam of light."

After contemplating the picture, by some device, the teacher makes known to the mind of the child, that when she speaks the word *hen*, his schoolmates all think of a hen, and in like manner, when the teacher points to the picture of a hen, they all think of a hen. In this way she developes in the mind of the child the fact that the spoken word and the picture serve the same purpose. As soon as the teacher is satisfied that the children comprehend her thus far, she writes the word *hen* on the board, near the picture, telling the children that also causes *her* to *think* of a *hen*. It may be well to write the word *hen* three or four times on different parts of the board, and call on the children to speak the word when it is pointed out. Although the children may not know other words, it is well to write two or three new words on the board in a column, one of which shall be the word *hen*, and request the children to find the word *hen* among them. A hunt will be made, and usually they will find the right word. (If the teacher should ask the children why the other words were not the word *hen*, they would say, "they don't look like it.") Then the teacher should write the word *hen* in *large* letters, so that the form of each letter may be seen by the children, and request the children to pass to their seats and write the word *hen*. About one-fourth of the slate should be ruled according to the German method, and the children should be taught where to begin. Encourage every effort put forth by the children. At the next lesson, she will ask the children how many of them would like to tell a story about the hen, and of course every hand will be raised to say something about the hen. In the meantime, while the talk has been going on, with a few strokes of the crayon the teacher has added some feature to the picture, — drawn a few chickens, or, it may be, a nest and eggs. (The primary teacher should be expert in the use of the crayon.) The children very quickly (associate the different parts of the picture thus made) tell many stories in their own child's vocabulary, thus carrying out

the teacher's plan for the development of ideas *first*, and then using words in naming and recalling ideas. As the children tell their stories, which, of course, consist of short, simple sentences, the teacher writes one or two sentences on the board, telling the children what she has written, or what she has written says. When they are through telling stories, pointing to the first sentence, which may be "I see a hen," she will ask what that says, and so on with the next, and usually four out of five will read what each sentence says. (Of course, the teacher has given the written word *hen* until she has drilled each child upon its pronunciation, and has been satisfied that each child could speak it without difficulty or hesitation; thus teaching the phonic analysis and synthesis of the word by pronouncing at first *slowly* and then *rapidly*.)

The children now pass to their seats, and take their slates and pencils and copy what is upon the board. (The teacher, when she requires the children to copy the sentences, should write a perfect copy.) The inexperienced teacher will find that it is an easy matter to employ the time of the children, and, at the same time, very profitably. The copying includes penmanship, spelling, use of capital letters, and punctuation marks, and even more, it teaches them to read their writing. After the teacher has written upon the board the simple stories told by the children, she should call upon each child to select a sentence upon the board, and then read and erase it, and then call on another child. This is an intensifying exercise, inasmuch as several pupils may have in their minds the very sentence which is erased, and they are obliged immediately to select another which in its turn may be erased by the next child called on. By calling upon the brightest pupils first, the teacher causes the dull ones to do the most work. If the child called upon cannot read the sentence promptly, another child is called upon to do it, and he selects another sentence, again causing the dull pupil to do the most work, and as use brightens the intellect, it not unfrequently happens that the ones who are the *dullest* at first, in a few weeks become the *brightest*. After the sentences have all been erased, the children are permitted to write as many stories as they can about the object on the board, and you may rest assured that for the next half-hour the children will give the teacher no trouble by any acts of disorder. Because there is an intensifying influence created upon the mind of the child, by the gradual growth of the picture, as it is produced by what seems to the child the magic art of the teacher, which is not exercised by the presentation of an entire picture at once.

Q. How do you proceed to teach the "idea" before the word?

A. It is a law of mental development, with which it is dangerous to trifle, that ideas should *invariably* precede words. It should also be a *rule* of *practice* that the pupil should not drop a *word* until as many of the

different ideas (of which the word may be used as recallers) have been developed as come within the capacity of the child's comprehension. Take the word *case*. We say of a horse, "he is in good or bad case"; of a man, "he is a hard case"; of a question at law, "it is a difficult case"; of a word, "it is in the nominative or objective case." An idea should not be left until as many different words as properly come within the capacity of the child have been given as recallers of the idea.

Q. When would you teach new words?

A. The teacher should *not attempt to develop* during the progress of the exercise an idea which was named by any word occurring in the reading lesson. Such development should invariably be performed at its proper time; that is, previous to the calling of the class. A teacher should never do for a pupil that which he is competent to do for himself, or what one of his classmates can do properly, if permitted to make an effort. A superintendent should so train his teachers that the teachers will not pronounce a word for a pupil during the class exercise; or even give conception of the right inflection and true rendering of the thought intended to be expressed by the author, until each member of the class has had an opportunity to give his conception of it.

Q. Have you a further test of grasping thought?

A. At the close of the exercise the pupils are expected to be able to close their books and give an intelligent *resume* of what they have read; and, if called upon, to substitute equivalents for words which the teacher indicates.

Q. Should a teacher ever pronounce a word for a child during the reading exercise, or give any conception of the right rendering?

A. Hence, simply speaking words promptly by the class is not considered a just standard for testing the quality of the best teaching; nor is any reading considered of the best quality which falls short of an ability to name promptly the text at sight, giving the eyes time to keep sufficiently in advance of the utterance of the words so that the mind may grasp the thought, and thus enable the pupil to give a proper rendering of it.

Q. What is the best standard for testing the quality of reading?

A. Reading is naming at sight the words of a written discourse in such a manner as to give a correct rendering of the thought to be developed or recalled, as indicated by the writer; and no exercise in reading is considered worthy the highest commendation in which there has been the slightest hesitation in the utterance of words, or in which the minds of the pupils have been from necessity so much occupied in recognizing the words that they have not been able to grasp the thought.

Q. In what way are pupils drilled on misspelled words?

A. The teacher while inspecting the slates also takes down all the

words she finds misspelled, and they are placed upon the board in the morning before school, to be copied by the entire grade, as "Busy Work." These words, with others that are used in idea and thought-developing exercises, are also used in an exercise testing ability to pronounce words at sight. The children, reading and removing the sentences from the board, as I have described, do not in this instance take their seats, but turn their faces from the board while the teacher puts several sentences on it. She then names one of the class, who turns to the board, and is expected to read one of the sentences instantly in the order indicated by the teacher, who changes the order as different pupils are called on. An exercise which precedes this is conducted in the same manner as that first described, only that, instead of merely pronouncing the words, the pupils tell stories about them. All this is preparatory to reading at sight. And here let me repeat (as I cannot too often), the teacher adds to her list of the vocabulary of the grade each new word as it is developed by the grade. Observe, I do not say *to*, but *by*, the grade; for the work is done by the pupils, not the teacher, so that there is no possibility of wasting time by going over work unnecessarily.

Q. It is not easy to obtain supplementary reading. Please tell us how we may optain it.

A. Inasmuch as script is used the entire first year in Quincy, up to last November there had been a need of suitable books for use in this grade; and though several highly educated persons had attempted to supply them, their attempts were unsuccessful. About that time, it was suggested that the stories told by the C primary grade in their written exercises would make excellent reading lessons for the D primary grade, and the idea was immediately put into practice, and a selection of the best of this work was made. By the aid of the lithogram, fifty or sixty copies of each story were placed in the hands of each D primary teacher. This I deem one of the happy thoughts of the past year. You will see that these written primers furnish a most valuable method for introducing a sight-reading exercise into this grade.

Q. How is sight-reading taught?

A. Before a sight script reading exercise (as a distinct lesson) is called, the teacher makes an examination of the lesson, and takes down those words contained in it not previously used in the grade. The ideas they are intended to recall are developed as already described. A page of this primer is sufficient for a single exercise. From this time, the grade has two sight-reading lessons a day. Permit me to remark that the secret of teaching sight-reading in Quincy is that no word is considered fully mastered until the child can call it at sight, and by using it in expressing a thought, showing that he knows its value. A single exercise in reading, or, indeed, anything, is continued only so long as the teacher is able to

keep up an intense interest on the part of the circle. As soon as the interest begins to flag, the programme is changed. With a proper teacher in charge, inattention or indifference is considered an indication of fatigue, and a variety is immediately introduced. Numerous kindergarten exercises are used for these changes; brief marches, or little songs, which are within the comprehension of the class.

Q. What are the other pupils doing? What is meant by "Busy Work"?

A. Although it does not necessarily form a part of a description of language lessons, you may wish to know what the rest of the grade are doing, while the teacher has a particular circle under her charge. They are kept occupied with what is called "Busy Work"; and this "Busy Work" is not at all the same in any two grades, but in accordance with the ideas and capacity of the teacher in charge. The "Busy Work" of no two days is likely to be the same, as there are so many kindergarten exercises of which any industrious teacher may make use. This "Busy Work" is always of such a character that the children are allowed all the freedom consistent with attention to the work. You may have read the anecdote going the rounds, of an old teacher, who, when visiting Quincy, remarked, "Isn't this very noisy?" and was answered, "Precisely, madam; this is a workshop, not a funeral. You cannot have a beehive without a buzz." And when she further noticed that the little boy in plaid was whispering to the little girl in white, was replied, "Quite likely, madam; we can readily find an excuse for bright-eyed, curly-headed, rosy-cheeked boys who will whisper to little girls in white; we once had a tendency in that direction ourselves." The principal difference between the work in language of the D and C grades is the changing from script to print; and I have found no teacher in Quincy who has any definite idea how the child comes in possession of the ability to read printed sentences, and of the names of the letters. Yet, although all the spelling in Quincy is phonetic, and the names of the letters are never used, the children know them as soon as the second year. Having thus given you a description of the language lessons for the first year, it is only necessary for me to say that the work of each succeeding grade is the same in principle, with such additions to methods and omissions of methods as the intellectual strength and mental development of the grade demand.

Q. You use various readers in the primary department. How do you proceed to make the children familiar with new words?

A. In the C primary grade the printed reader is introduced. As before stated, the child is already able to recognize the printed word at sight, to the extent of the vocabulary he has acquired. Daily drills in phonic analysis have now fitted him to pronounce words by the aid of study. The teacher has a list of the words in the vocabulary the grade

has thus far acquired. In order to lessen the labor of the teacher, a *resume* of the vocabulary of a large number of the first readers, most highly prized, that are in use in the schools. You will be astonished when I tell you that this *resume* only covers between three and four pages of an octavo leaf. The words are arranged phonetically, and, as near as possible, in the order of their occurrence in the readers. You will all perceive that when the teacher has developed the use of this list of words, and fixed in the mind of the grade their forms, the members of the grade are prepared to read at sight, in the most perfect manner, all the lessons found in the entire series covered by the phonetic *resume*. All the devices used in the D grade primary teaching of language are continued in the C grade, the main difference being the grade of thought developed: hence, a higher grade of pictures, suitable to suggest such a thought, is needed. More importance is placed upon the child's ability to frame sentences containing numerous word and phrase adjunct elements than has been in the D grade work. In fact, the children in the C grade in Quincy, during the last four months of the work of the grade, find little or no difficulty in expressing thoughts, both orally and with the pen, by the use of sentences involving not only the use of *word* and *phrase*, but also *sentence* adjuncts. This ability is considered one of the best evidences of the highest order of work in the D and C grades in language teaching, provided the vocabulary is not above the grade work. In this grade work there is introduced another method in testing the ability of the child to write words correctly.

Q. Do you permit pupils to study their reading lessons before recitation?

A. When the hour for sight-reading has come, and the child is placed in position, the teacher names a pupil, who steps to the cupboard, and when the teacher names the set of books she wishes used, the monitor passes a book to each member of the class. The books are in sets of twenty-five, for the reason that experience has taught them that is the number which can be profitably engaged in this exercise at one time. The teacher then names the page on which the lesson which she has selected for the exercise may be found; and for the sight-reading of which she has prepared the class, by developing each word contained in the lesson not previously within the vocabulary of each member of the class. The books are opened, and the teacher names a pupil, who at once commences reading, and continues to read until the teacher, for some good reason, desires another to take his place. If a pupil hesitates in naming a word instantly, another pupil is named, who commences where the previous one commenced. If any pupil thinks that a word has been miscalled, or that the reading has not conveyed the thought intended by the writer, up goes his hand, and, as soon as the teacher deems it advisable, she names the

owner of one of the "hands up," who tries his luck, but you may rest assured that very soon the thought is brought out, and the exercise goes forward. If the class cannot agree in regard to the thought the author intended to express, the utmost freedom is allowed the class in discussing the matter among themselves. If they do not finally agree, a note is made upon the board, and the subject is passed for some future occasion, giving the pupils ample opportunity to gather, from any source they may, such information as will furnish evidence to settle the point of difference. In the meantime, during the exercise, the teacher has made a note of all the words upon which any member of the class has hesitated, which words go into the list of *very difficult* words for future development. After continuing the exercise the proper length of time, the books are taken up, replaced in their case in the cupboard, and the class permitted to write a *resume* of the reading lesson, which is examined by the teacher, and the members of the class credited according to their deserts, by the aid of the most beautiful and ingenious device I have ever seen, and which I regret not having time to describe. I would also say, that while examining the *resume*, the teacher makes a note of each word misspelled, and writes it on the board to be copied by the class. Sometimes an oral exercise is used in place of the written one, but this is seldom done, it not being considered a good test, or one worthy to be relied on, but is used rather as an exercise in oral expression.

There are fourteen sets of books belonging to the C primary grades, nearly all of which are read through by each grade in the course of a year. So, you see, the children of this grade have a great deal of sight-reading in the course of the year, all of which is fresh when it comes into their hands; and the condition of the class, when it is called upon to read, very much resembles that of a healthy child who has breakfasted at six, and is invited to sit down to a well-loaded table at noon, without having had his appetite spoiled in the interim by a piece of pie or cake; and, I must here remark, that I never saw children at a picnic, after having gone beyond their usual hour of eating, show greater enjoyment when refreshments were finally served, or their eyes sparkle more brightly when the confectionery came, than those of this class when they found the lesson they were to read was such a story as most children delight in reading. In fact, I never knew how interested children of seven or eight years of age could become in healthful reading, until practised in Quincy schools; or how truthful the remark I have often made, "that the best example in reading which can be given a person to study is the animated conversation of an intelligent child of seven, eight, or nine years, when talking upon a subject with which he is familiar, and which comes within the range of his mental development and vocabulary." Children in Quincy read as they talk, and I have often tried the experiment of turning my

back to a class, in order to know if I could tell by the tones of the voice whether they were reading or talking, and in a large majority of cases I have not been able to tell.

Q. Have you any other device of teaching reading?

A. A good way to teach is by writing a small word, and then causing the pupils to trace it with their fingers in the air. Progress should be so slowly and patiently made that the child would never imagine that it was doing a difficult thing. From the start a child should never be allowed to do a thing wrong. As we learn to do a thing by doing it, a child could only be taught to do a thing correctly by never being allowed to do it wrong. Care should enter into this work, and praise should be judiciously bestowed.

Q. Some teachers, in teaching the child to read, begin with a drawing. Do you approve of it?

A. No. Any method that makes drawing precede the idea is wrong. Let the pupils close their eyes, and see the word in their minds.

Q. What words should first be taught?

A. The favorite words of the child should be used. The first book should be printed in the child's own idiom.

Q. What is the limit of a child's vocabulary?

A. The number of words that the child can recall is the definite boundary of his vocabulary. Learning to read is learning a vocabulary.

Q. How do you manage to keep up an interest in reading, with beginners?

A. Keep up an appetite for a *new* word; so work that every face will brighten up when you say, "*a new word.*" Let a charm hang around the *new word*, and when you say, "Children, we are going to have a *new word* to-day, and I want you to find it, and I will introduce it to you. It is a stranger, and we want to get acquainted with it."

Q. Some teachers say they cannot teach children to read without combining the use of the chart with the blackboard.

A. Blackboard is better than the chart. *Chalk* and *talk*, — a limited use of both. A skilful teacher needs no chart. Use script for five months. When to leave off script and take up the chart depends upon the ability of the child and the skill of the teacher. If a teacher cannot succeed with the blackboard in teaching script, let her take chalk and print.

Q. About how much reading would you have from the blackboard?

A. Work slowly, and have the First Reader read nearly through on the board before the book is given. By doing this we find it is not difficult for them to keep the place. In the reading class, thought-analysis should be the most prominent feature.

Q. Why do you prefer the script in teaching the child to read?

A. Script is the method of economy. The child not only gets the

thought, but it enables him to give the thought; the child gets the thought, and gives it right back to you. This is its *excellency.*

Q. How would you change from script to print?

A. Fill up the board with a nice little lesson; let them read it. During their absence change from script to print. Request them to read it. They will do it immediately. They will see a resemblance. I will first explain why we begin with script. First, because you can work more rapidly with script than print; second, because the child works from the blackboard, combining reading with spelling and composition at the same time. We keep the pupil at script, say for five months, and the change to print is then made with ease. The way it is done is this: we write something on the blackboard, and the children *read* it and *copy* it on their slates. After they go home it is rubbed off from the board, and the same matter is printed by the teacher. On the return of the children, they read the print with very little hesitation; they learn to read the print in a day or two. Children don't see differences like grown people; they see likenesses in things quicker than older folks.

Q. Does the change from script to print discourage the child?

A. Having progressed so far, a change is made from script to print, but the change is effected under such circumstances that the pupil don't notice it. When they have learned to read I give them plenty of reading matter, say six or eight different first readers, so that the result of their studies will be entirely devoid of the mechanism that characterizes the studies of the public-school child. I would not have them read *over and over again* the same book, as is the case in your public school to-day.

Q. Why not begin to teach a child the sounds of the letters?

A. If we take in a part of the thing, it weakens the power to see or understand the whole.

Q. Why do you use the word method?

A. Because it is the natural method; the sentence method is also the natural method; the script method is economical, because while you teach the script, you are teaching penmanship, spelling, and reading. Use all three methods; in them you get the strength of the bundle of twigs.

Q. Some teachers object to the sentence method because the thought is composed of words, violating this principle, "Teach one thing at a time."

A. A thought is a unit of mental action. A sentence is the unit of language expressed.

Q. When would you take up the sentence in reading?

A. When eight or ten words have been learned we have the foundation for several sentences.

Q. Would you require teachers to put reading books into the hands of beginners?

A. The best teachers of reading do not put books into the hands of the beginner. They show an object to the child, and write its *name* on the blackboard. The pupil learns, after a practical drill of this kind, that *words* are but *names*; when this stage is reached it is proper to give him a book, but still the blackboard is to be steadily and methodically used. This is a great advance upon the old method of *spelling out* the words. Let the words learned each day remain on the board, and be put on the slates while in their seats; it is not expected that young children should study — that must be learned. I would group ten together, according to their mental calibre, and use the blackboard till they can read without difficulty.

Q. Would you call upon pupils to read round by turns?

A. But very little attention should be given to such an exercise.

Q. What is your opinion of silent reading?

A. I favor it. A very profitable and pleasant exercise. I would let them read silently for a few minutes, and then take their books away, and question the class in regard to what they had read; sometimes I would request them to reproduce the thought orally, at other times I would have a written reproduction.

Q. What is the most essential point in primary reading?

A. The most essential point in primary reading is to lead the pupil to see and understand the thought before giving expression to it.

Q. Do you consider that getting the thought is reading?

A. Yes; you cannot read well orally without getting the thought, and so the first work is to get the thought; this is done by silent reading. Gaining the thought is the first work; you must first gain money before you can use it. Let that be your sun by day, and your moon by night.

Q. Do you not think that too little attention is given to thought reading?

A. All reading should evolve thought; every lesson should evolve thought; every lesson should be reproduced; giving back the thought is a part of the lesson.

Q. Can thought and expression be divorced in reading?

A. Thought training, and expression training go hand in hand; the expression measures the power and the intensity of the thought.

Q. Is not the reading lesson the most fertile field for the development of thought and expression?

A. The reading lesson is one of the best exercises in school. It includes so much matter — frequently a lesson contains something on history, geography, biography, manners, and morals — a good opportunity is afforded for language development.

Q. Which should receive the more attention in reading, the interpretation or the expression of the thought?

A. More attention should be paid to the *interpretation* than to the *expression* of the thought. A pleasant and profitable exercise is *silent* reading of the lesson by the pupils, after which the teacher questions the pupils about what they have read. One of the most promising results which I find is the steadily increasing power of children to study, to concentrate their minds upon, and to master the thoughts that are awakened. The love for books and reading is increasing with rapid strides. Books should not be put into the hands of the little ones, until they are ready and eager to use them, and then only when they bring pleasure to the readers, thus keeping the appetite for reading keen and active. The large number of books (in sets of twenty-five), owned by the town, forms a circulating library, furnishing a great amount of excellent reading. Good reading is one of the direct results of good teaching.

Q. Why do so many children read unnaturally?

A. We destroy naturalness, because the child's attention is diverted from the whole to the part. The very struggle of the children shows the lack of originality; shows that nothing is coming from the mind but mechanical association, not sense association.

Q. How would you prevent hesitation and unnatural tones in reading?

A. Pupils will not hesitate and read in unnatural tones, if they are taught properly: these are acquired. In order to prevent it, let the pupils read the sentence through *silently, before giving oral expression to it.* The understanding of the thought is the main feature. By this plan, children will not hesitate in reading, nor use unnatural tones. In the lowest primary grades, sight reading should receive close attention.

Q. Should a teacher read a sentence, giving the proper emphasis, for the benefit of the child?

A. Emphasizing for a child is not development. If the child does not see the thought, develop it. If he has *the thought in his mind, the thought will control the emphasis.* If the teacher reads the sentence, she gets the benefit, not the child. *Never teach pupils to imitate your voice or expression in reading. Let him develop himself, in order that his efforts may have some individuality.* If you would learn to read, listen to the child's reading.

Q. Why do the children give the wrong emphasis?

A. It is evident that they do not understand what they read. The teacher should so question the pupils that they may see their faults; but not tell them.

Q. How would you proceed to examine the first five months' work in reading?

A. Examine the pupils from the blackboard, using the vocabulary presented by the teacher, which the pupils have learned. Second five months in very short, easy, printed sentences.

Q. How would you proceed to examine pupils in the first and second readers?

A. By requiring them to read from readers which the pupils have never seen.

Q. How should a superintendent examine a class in primary reading?

A. The teacher should know how many words she has taught; she should keep a list of them for the examiner, who should test the child's idiom.

Q. What should be the test of reading in examinations?

A. First, to be able to read without hesitation; second, to be able to get the thought; third, to be able to express it; fourth, to be able to reproduce the thought; fifth, to be able to give a reason for the use of capital letters and punctuation marks.

Q. What should be the standard of examination of reading in the lowest primary classes?

A. The habit and power of getting thought before it is given (expressed orally); the habit of giving the thought just as the readers should talk.

Q. How do you foster a love for reading?

A. A love for reading is fostered by the teacher, who takes some standard book into the school-room, and reads from it and talks about it until "each child is full of enthusiasm concerning it, and all are anxious to read the book at their homes." Another is commenced in the same way, and the interest increases; thus a love for good reading is created.

Q. How does the child learn new words?

A. By unconscious analysis he makes the word the same as he makes everything, or tries to make everything.

Q. Do you say that a child should write a legible hand at the end of the first year in school?

A. Yes; this may be done through persistent work. At the end of the second year every child should write a beautiful and rapid hand, using pen and ink.

Q. Should the teacher, from the first, give attention to technical writing?

A. Technical writing should be taught from the first, beginning with the letter "i."

Q. Do the children get sufficient reading-matter?

A. The amount of reading which can be disposed of during a year in a good primary school is amazing. Such books as these are simply devoured by children who have hitherto been starved so far as their fancy and their imagination are concerned. If any one cares to test practically how strong the interest of children who are thus taught really is, he has only to buy a dozen picture-books, or, indeed, story-books of any kind, go to some primary school where this system is in successful operation,

and tell the children that he has brought them something new to read. He will probably be satisfied that there is no lack of eagerness about him, and the little people know quite well what they want.

Q. Where do you obtain sufficient supplementary reading?

A. From juvenile magazines, reading-books, and selections from the daily and weekly press.

Q. Would you have as much oral reading as some teachers do?

A. Get at what is meant first, and the expression will follow as a matter of course.

Q. Should any elocutionary drill be given?

A. I don't believe in this so-called elocution. There should be no reading by the teacher to instruct the pupil in pauses, emphasis, etc. The boy should be made to read it himself, so that you can get at his thought. Reading is a means of study, and the getting of thought by means of words. Any training that teaches words, and not thought, is mischievous. The teacher discovers what is in the mind of the child by making him read the book himself. If the teacher does it for him, she does the thinking, and the boy imitates the tone of the voice, and when he in turn reads, you cannot tell whether he has got the thought or not. Thought is *impression*, and reading aloud is *expression*. I would have more than one text-book; there ought to be several very easy readers, instead of having one book which the boy learns by heart. In Boston we have several sets of primary readers, and when one school gets through with its set, it exchanges with another school, and thus the children have new reading matter all the time. We make good readers in *three years*, and finish the instruction in reading, as reading, in that time. That is a strong statement, but it is *true*.

Q. Are the readers properly graded?

A. The change from the First to the Second is too great; the child has gone out of his idiom in the Second.

## A Conversational Reading Exercise.

"A quotation; somebody else wrote it." "Anybody know who wrote it?" Nobody did. "Find out at the library." Again, reverting to the main subject: "Our ships at Quincy don't come up to Mr. Wilson's store. How is it that these boats do, in Holland, come to the store doors to unload?" "Canals; the streets are canals." "Any other place in Europe where the streets are water?" Boy locates Venice on map, and makes a dot for it. His neighbor makes his dot for it at Sicily. "How many," pointing to this last, "think this is right?" Nobody rises. "How many don't know?" Three or four rise, not in the least ashamed to be ignorant, but evidently "wanting to know." The majority of the class, how-

ever, rose to the opinion that the first draughtsman had put *his* Venice in the right place; and the second one, thus corrected, but not snubbed, made his repairs accordingly. "What should we see people walking on, in Holland?" "Stilts." "No; that's in Sweden," says a class critic. "Wooden shoes." "Any other place in Europe where the people wear wooden shoes?" "Constantinople." "Russia." "*French* peasants." "Any part of our country?" "There are boots," said slowly a junior Emerson, "in Mr. ——'s store window, with wooden soles about an inch and a half thick." Finally, it was brought out that in Canada you could still see and hear wooden shoes among the French farmers around Quebec.

It was not easy to leave this class for the history lesson, but time was flying, and in Miss Dearborn's room already Columbus was making his voyages across the Atlantic. The little girl at the blackboard dropped her voice, as the visitor entered, but was promptly reminded by the teacher's "I can't hear a word you say" to take up the narrative in a clear voice. In this room, another earth-map of North America lay on the blue-board, but America was discovered (this being an older class) by the blackboard above. Columbus sailed out into space, and the islands were put in "as he sailed," or rather when he came up to them, the track of each voyage drawn across the Atlantic. This was after England and Spain had been put in for the Genoese voyager, and after Queen Isabella had sold her jewels, to the approval of the class. "A priest thought considerable of Columbus, and he got a part of the money for him, and the Queen gave the other part." Palos is located, and the date of the first voyage written there. "Then he sees the Canary Islands." "I don't see them," said the teacher: so they are dotted into place. "What was Columbus doing when he stopped there?" "Repairing his ships." "What date do we want all along here?" So the sailor took her to San Salvador, and writes October; takes her from there, goes on to Hayti. "Did *he* call it Hayti?" "No; Hispaniola;" and brings him back to Spain by a chalk sail. "What year?" "Early in 1493." Here the superintendent, Mr. Parker, comes in and looks on, but says nothing. Columbus gets his reception in Spain, Indians and all, and is taken out again to San Domingo, while the class discovers Jamaica, and the chalk voyager marks it in place, and dates it. "Stays about here till 1496." On his third voyage, the Cape Verde Islands are discovered in the track of the chalk pencil. "Why Verde? What *verd* have we in our names?" "Vermont." By this time a party of earth-workers were putting in the islands on the earth-map, following the instructions from the little leader at the board.

Not all history can be taught in this way, but that of the United States, especially, gives a good field for it. Even in political history of the Old World, what life and action may be given to the details, for instance, of

eventful wars that have changed political boundaries; what interest to the character and civilization of any people, to follow out, by the earth-maps, and by blackboard lines, the marches of contending armies, or the local peculiarities of a nation that come of its frontiers, its access to neighbors, and spirit towards neighboring States, and its commercial opportunities! The earth and chalk empires can grow and spread, and shrink and fall, by means of these pictures under the fingers of the little workers, and even old Cadmus, "bringing letters into Greece," will not seem so much connected with the postal service as he now does, when the children can follow his voyage, and fix the rich country he came from.

Going into the next room for the language lessons, I found an arithmetic class, one of the primaries, just finishing its work, being delayed a few minutes by some questions that the superintendent, Mr. Parker, had been asking. I could not judge of this exercise, therefore; but it was evidently not so mechanical as the New York schools, nor had it such lightning calculators. The points were brought out that you couldn't divide minutes by apples, even if you should succeed in eating fifty-two apples in a day; and the lesson was kept well down to numbers simple. So far as I could see, the reason was at work quite as much as the rule. Is considered of great importance, as quickening observation out of school and expression in class. There were quite young children in the fifth primary. The talk was about the cow. A child starts up: "*I* would call the cow an animal." Another: "*We* would call the cow an animal." "The cow is an animal." "*Every* cow is an animal." "The cow is a tame animal." "The cow is a domestic animal;" and so on, each child making a new sentence, and all enjoying the rapid game of changing sentences. Teacher: "We will write the name of the cow. Is this right?" putting a small "t," a small "c," and an interrogation mark. "No; we are not asking a question, we are telling something; we don't want that mark." "What then, this '!'?" "No; only a period."

Also directed, she writes a capital "T" and "C." "What is a capital?" "A head letter." Now, we shall write down all that we can recollect about the cow. "What does *recollect* mean?" "To bring together again." First we shall write the color. "What is the color of your cow?" to a small girl, who immediately responded that the color of her cow was pure white. Teacher writes "white" at edge of board, making "whi" with the "te" on next line, but is reminded by the class that it cannot be divided, no more than *and* can. "What shall I do, then?" "Leave the space, if there isn't room for it all, and put it all in the line below." Then again the cow was tossed from bench to bench. "The color of my cow is clear black." "My cow is pale red and white." "The cow I saw this morning was black and white." "That cow is black." "Is the color of your cow red?" "The cow I had was brown." "Is

your cow tan, like mine?" "Why don't I call that horse a cow?" This was the turn for a new series of observations. "You can tell it by the noise it makes." "A horse hasn't got any horns. It hasn't any bag." "You can tell it by the hoofs." "The cow's hoofs are split." "Did you ever notice how funny the cow's hoofs look?" "My cow has cloven feet —*cloven* means *split*." "The cow's hoofs have the same substance as our finger nails." "Cow's hoofs always cover their toes." "My cow's hoofs are not perfectly round." "All animals have split hoofs except the horse" was one contribution from a boy who hadn't got his summary quite clear. Instantly there was a chorus, "A dog! A dog has no hoofs." "A cat." "A rabbit hasn't any." "A mouse." "A pig." "A pig *has* hoofs." So the teacher got out the picture of a pig, to satisfy the demand, holding up successively an ox and a turkey, a dog, and so on, to set the animal philosopher right in his summary, and on his feet again. "You can tell that a cow isn't a horse, by the horns, you say?" "Let us talk about the horns." "My cow's horns turn outward first, and then inward." "I think the Chinese finger-nails look like horns." "It hurts to saw off a cow's horn — it will bleed." "What's the use of horns?" "To make combs out of." "Cows don't make combs out of their horns. What is the use of horns to the cow?" "Oh, to hook with." "When a dog goes at her she will bite." "She can't bite anything but grass. She *has* to hook dogs."

The various points that were brought out were written on the board by the teacher, as the talk went on, but the main object, to get a varied expression of a familiar subject, in a class of quite young children, was shown in the rapid tossing of sentences from one to another, and no repetition nor stammering in the class. The horses and cows talked about were in view from the window of the school-room, to be sure, but the city child can be taught to get its observations from the car horses, the animals in the Zoo (which ought to be open free to the public-school children for their object lessons, at certain times), and from all the variety of our street scenes.

The three hours spent at the Quincy school were all too short, although much of its method was shown in that time. They were long enough, as visits to other school-rooms have shown by contrast, to demonstrate that the noon bell found children, visitors, and teachers all fresh, instead of drained and dull by text-book and routine. The teacher is the only text-book, and I was anxious to learn the effect of the new system on these young girls and mature women.

## SUMMARY ON READING.

The results in Reading, Writing, and Spelling bear no just ratio to the time and effort given to these branches.

Definition of Reading. Reading consists: first, in gaining the thought; second, in giving expression to the thought.

FIRST: *Gaining the Thought.*

(*a*) Through silent reading, — this is fundamental. Purely a mental act. Called eye reading.

(*b*) Cultivate "sight reading" (eye reading) from the first.

(*c*) See that the pupil acquires the power of directly receiving thought from the printed page.

(*d*) Let the child "learn to read by reading."

(*e*) Nothing of detail or analysis (as spelling, punctuation, pronouncing slowly), inflection, or emphasis should stand in the way of the clear comprehension and expression of the thought.

CAUTION. — Concentrated attention of both teacher and pupils.

SECOND: *Giving the Thought.*

(*a*) Let the sentence be read mentally, that is, silently; read to one's self before giving oral expression to it.

(*b*) Do not let the pupil read a sentence aloud, that is, orally, until the thought is in the mind.

(*c*) When the thought is in the mind *it will control expression;* the sentences will be read naturally.

(*d*) Bear in mind that oral reading is subordinate to "eye reading."

(*e*) With the child, the "unit of thinking is the thought, and the unit of expression is the sentence."

THIRD: *Preparatory.*

(*a*) Let there be kept up continual expression of thought by the pupil, with the use of objects.

(*b*) Let the transition from the written work to the book be done cautiously. It will require only a few lessons to make the transition from the board or slate to the book.

(*a*) Teacher should become familiar with the lesson.

(*b*) Give books to pupils after they are arranged in the class.

(*c*) Let pupils look over the lesson for unfamiliar words.

(*d*) Pupils close book, and teacher develops the meaning by questions and answers.

(*e*) Pupils use new words in the construction of sentences.

(*f*) Write new words developed on the board.

(*g*) Pupils look over each sentence carefully to see if they can understand the thought.

(*h*) Pupils read.

Everything written on the board should be absolutely correct.

First — *In spelling.*
Second — *In the use of capital letters.*
Third — *In punctuation.*
Fourth — *In grammatical construction.*
Fifth — *In penmanship.*
Sixth — *In form, such as index, margin, etc.*

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## SPELLING.

*Question.* Does not the teaching in the primary grades lack simplicity?

*Answer.* I advocate a grand simplicity of teaching. According to the present method of instruction in the public schools, a child is told to spell "hat," and having done that, is shown the article. I would first draw the hat on the blackboard, and then tell the child to bring it to me. The idea is grasped at once. It is detrimental to progress to teach the child the word so that it must be mentally analyzed before the youthful mind can understand it. According to my method, the boy *learns to write the word when he sees* the article, by identifying the name of the article with the article itself. I am the *deadly enemy of empty words*, yet millions of dollars are annually expended in the teaching of empty words.

Q. What should the first year's work do?

A. The first year's work should be to prepare the child for the work of composition. The year's work should be spent in acquiring the forms of words — COPYING — so that the child would not be compelled to struggle with them afterward. Particular attention should be given to the use of words. The method I would recommend would be to write familiar words on the blackboard until they could be written rapidly and correctly by the pupil. There was no necessity for their making mistakes, if thoroughly trained in the beginning.

Q. How would you teach spelling, the second year?

A. During the second year's work, children should be taught by causing them to write upon a slate all the words they know. If they had been thoroughly trained the first year, they would never make a mistake. Then these words should be combined into sentences, which might be written upon the blackboard and copied. Afterward, these sentences might be erased, and written again from memory. He would take his seat in a chair, then call upon the pupils to tell what he had done with a pencil. Or, he would walk to the window and open it, with the children watching

him. Then he would call upon them to tell what he had done correctly. These sentences should be begun with a capital letter, and ended with a period, every time. When a child wanted a new word, the mind should be first aroused to the necessity for it. Then the word should be written on the blackboard. It was wonderful to all how readily and how permanently words might be acquired, if taught in this manner.

Q. Would you teach the sounds of letters?

A. No spelling by sound at first; let them pronounce slowly. Words should be taught as *wholes*, and when pupils are sufficiently strong, let them analyze the words. Go slowly, *slowly*, SLOWLY; ten words well known are better than one hundred not well known.

Q. What relation does oral spelling hold to spelling?

A. The same relation that description does to drawing.

Q. How would you proceed to make the child understand?

A. Never let a child guess at a word. Every wrong form you get into a child's head stays there. Real teaching is by object; and if this method is observed, the child learns the words with ease, and can be taught to talk as eloquently and as beautifully with the pencil as with the tongue. The effect must be in the mind of the child, or the teacher must present it, otherwise there can be no mental action.

Q. Would you use a spelling-book?

A. I would teach spelling along with reading. I would teach him to talk with the pencil from the start. It is grossly wrong to teach the pupil to spell from monotonous columns of words. If I do nothing more than to banish the spelling-book from the public school, I will have done a great work. If I had my way, all the spelling-books in existence would be heaped together in one pile, and burned. I assure you that if this were done, they would shed more light in this dark world than they ever did in the school-room.

Q. How would you proceed to conduct the spelling exercise?

A. I would have the children at first copy the work on the slates; second, write from dictation. The teacher should always examine the slates of the pupils, and instantly erase all misspelled words, and write the correct form. Get the word incorrectly spelled out of sight as soon possible. The teacher should keep a list of misspelled words, and call them her list of "difficult words," and require the pupils to write and re-write until they are learned.

Q. How would you advise teachers to drill a poor speller?

A. If a word is misspelled by a pupil, put it on the board, and drill the whole class in every possible way (seeing that this pupil is giving close attention, and not let him know that all this work is for his benefit); after sufficient amount of drill is put into it, let him point to it on the board, ten, twenty, or as many times as the teacher may see fit, until he is able to spell it.

Q. We wish to know more about the spelling exercise, — inform us.

A. Every word which the pupils have found difficulty in mastering is placed upon this list in the order of its occurrence, as is also every other word in the spelling of which the children fail. It is a notable fact that the most failures are made in words in common use; therefore, the spelling of each grade is confined to the words in use by the children, and those they are likely to use within a few years. Thus the spelling of the words belonging to the vocabulary of each grade is taught in that grade. Besides these words which occur in other lessons, a large proportion of this list is composed of words given by the class in special exercises, which may be called "word-developing exercises." No word is placed upon the list until it has first been written upon the blackboard, and copied by the children upon their slates. No word developed in these exercises is left until it has, either orally or upon their slates, been embodied by the children in sentences framed by themselves, as a test of their knowledge of the true meaning of the word. I have repeatedly spoken of the *framing of sentences* by the children, and lest the expression may mislead some one, hasten to explain that here they do not "make a sentence," but "tell a story," about the word; and the child is at liberty to say as much as he will about the word, provided he does not occupy too much time; the object being not to limit the child's flow of thought or expression, but to afford both the fullest liberty consistent with improvement; and when the teacher says, "Who will tell me a story about the word *cold?*" there is no constraint on the part of the pupils, but they pour forth all they think that shall express their idea of the word, thus: "This is a cold day." "I saw a little girl on my way to school who looked as though she was cold." "I shall eat a cold dinner." One of these word-developing exercises is conducted thus: Each child in turn is allowed to touch something in the room, the name of which is put upon the board. This association of the name of the object with the object itself is a great help. One lady says there are over 300 objects in her room which may be touched. Any peculiarity of spelling is spoken of while the word is being written upon the board. If there be silent letters, a line is drawn through or under them to attract attention to them. The words thus developed are all name-words. At first it seems next to an impossibility to represent action-words; but I am assured that they are all, or nearly all, capable of representation, which is done either by the teacher or a pupil previously instructed. The word *run* is readily represented, if a pupil run across the room; and at the same time the word *stop* is suggested. Not only the words, but their different forms, are thus illustrated, as: Drop, dropping, dropped; walk, walking, walked. In obtaining descriptive words from the class, the teacher has often to resort to questioning, though sometimes these, too, can be illustrated; as, for instance, the teacher takes a

flower from her vase and smells of it. Such words as sweet, fragrant, odor, handsome, scent, will be suggested.

Q. How do you test the work in spelling?

A. The committee furnishes each teacher in town with slips of paper, called "Dunton slips," and when all the previous methods for fixing the word in the mind of the child have been correctly used, one of these slips is given to each member of the grade, and the teacher, from her list of difficult words contained in the vocabulary already acquired, pronounces as many words as is desirable to constitute a written spelling lesson or exercise, and each child writes the word instantly after it is pronounced. The slips are then taken up and passed to the teacher, who, at the proper time, examines the papers, and makes a note of the words misspelled, in another list, which she keeps as a list of *most difficult words.* I should have said the first thing done by the pupil, after receiving his slip, is to write his name at the head, also the name of the grade, and the school, town, county, and state, the hour of the day, the day of the week and month, together with the year. When a sufficient number of words have accumulated in *the very difficult* list, these words are redeveloped from the insipient steps, through to the final test; thus making it almost impossible for a pupil, in after life, to be at a loss how to spell each word correctly.

Q. Do you think it best to require pupils to write a misspelled word a certain number of times as a punishment?

A. I would not require the pupils to write a word a certain number of times as a punishment, except for persistent carelessness.

Q. How would you train pupils on hard words?

A. Suppose the word be *locality.* Request the child to read the sentence again, and let him say *places,* as he goes on without stopping to the end. This synonym exercise should be required, when necessary, on hard words, and let the substitute be made when he reads, showing that the entire paragraph is understood.

Q. How do you teach the use of the word?

A. We teach the use of most words through syhonyms.

Q. How would you proceed to teach the meaning of a word?

A. After a pupil has read a sentence or paragraph, I should ask him to give a synonym in the place of some selected word, or to use some word he has just read, in a sentence of his own; or, I might give him a word from the sentence, to be used in a sentence written on the blackboard, while another pupil is reading.

Q. How is the true meaning of each wcrd tested?

A. After the lesson has been well studied in this matter, the children's knowledge of the true meaning of each word is tested, as I have before said, by sentences, or stories told by the pupils, and containing the words

in the lesson. No sentence is accepted which does not convey the meaning. "She is sorrowful," is not satisfactory, but "She is sorrowful because she had offended her mother," shows the desired knowledge in regard to the word *sorrowful.* This story-telling is often conducted in the following manner, which will be recognized as intensifying in the extreme.

The children are permitted each to select the word about which they are to tell a story, and as their teacher calls them by name, each tells his story, and stepping to the board, erases the word, after which he passes to his seat. I observe that there are usually as many words as pupils. I also observe that the teacher invariably calls on the brightest pupils to tell their stories first, and, in consequence, the dull ones have sometimes to select a number of words, and have stories ready several times before they are called upon. If a pupil is not prepared with a sentence, he is not reprimanded, or called stupid, but some other takes the word and goes on, while the delinquent makes haste to select again, and prepare for a more successful attempt.

Q. How would you aid the pupil to acquire the *use* and *meaning* of words?

A. The knowledge of the pupil, as to the significance of words, is aided by "learning at least four lines of choice poetry each week." This exercise seems to improve the pupil in reading, and in the use of language, in a marked degree. It is also an excellent practice for the cultivation of the memory, and a source of much pleasure to the pupil.

Q. Why is it that so many adults spell poorly?

A. Bad spelling is a product of the schools. The teacher should never receive any careless work, and should ever enforce the necessity of care. Everything a child does should be inspected and marked. There was no use of a pupil doing work, if the teacher did not see it. Teachers were sometimes careless themselves, which he thought an inexcusable fault. There should be no oral spelling during the first year, and *absolute correctness in copying should be enforced.* A skilful teacher could thus lead the pupil to absolute accuracy. He could not too strongly impress upon teachers the value of this rule. There was only one right form for a word, and if one or more wrong forms were used by the child, they would be reproduced in after life in the most unexpected manner and time. He condemned the spelling-book as a "wicked thing." By his own method, a child could be taught to spell almost every word correctly in three years, but he challenged any one to produce a similar instance of success by the spelling-book method.

Q. What should be the standard of examination in copying sentences?

A. The standard of examination should be absolute perfection in copying sentences from the blackboard, the words of which (sentences) have been previously copied by pupils.

Q. Would you request the children to write sentences?

A. Yes; as soon as they can, let them talk with the pencil from the slate.

Q. What kind of sentences should be dictated in primary grades?

A. Teachers are to keep the list of words learned by the pupils, and the sentences dictated should be composed of these words.

Q. How would you mark errors?

A. If there is a *single* mistake in spelling, capitals, or punctuation in a sentence, the sentence should be marked wrong.

Q. What is the value of a sentence?

A. The value of a sentence is the thought.

Q. How do you lead the child up to understand the thought?

A. The value of a word is the value of the idea of which it is the sign; therefore a word is of no value unless it recalls an idea, and children are never allowed to think they have read a sentence, if the thought it contains is not understood. Comprehension of thought is absolutely essential to proper expression; that is, a thought in the mind is the incentive to emphasis, inflection, modulation, and pauses. If the *thought* is grasped by the pupil, the *expression* will be natural. It follows that a sentence cannot be properly read until the thought be perceived by the pupil, — now, how can the thought be perceived by the pupil, unless the ideas which the words are intended to recall have been developed in his mind previous to his attempt to read? "The letter killeth, but the spirit maketh alive."

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## LANGUAGE.

*Question.* Do you teach language specially, or only incidentally?

*Answer.* Language should be taught in connection with, or rather incorporated in, each exercise; aside from this, there should be a portion of time set aside for *special drill* in expression, termed "conversational lessons."

Q. What is the object of conversational exercises, as you call them?

A. To teach expression and readiness; also to train children to use their eyes.

Q. How would you begin to teach language?

A. Do something, and let the child tell what you did. *Accurate description is the highest point of composition.* Let them see thought of God in Nature. Give the child plenty of food from which to get thought.

Q. How would you teach language to little children?

A. First, do something; second, ask the children what you did; third, let the children tell you by writing it.

Q. How do you teach language in the primary grades?

A. One of the most valuable methods of the "new departure" is the use of pictures. The teachers are furnished with all the pasteboard, cut into graded sizes, necessary to back all the pictures they can collect; and by mutual exchange, each teacher secures a large number of pictures suited to use in her grade. These pictures are classified according to their adaptation for particular class exercises, and kept in boxes (which are also furnished them), each box being labelled like the pictures it contains. Each teacher has a catalogue of her pictures, numbered so that she can readily get any one that she desires. These pictures are now used just as blackboard pictures have been heretofore, but more especially for the purpose of cultivating the perceptive faculties, particularly the eye. Each child being given a picture, he is permitted to tell or write all he sees in it; and, to a stranger, it is astonishing to perceive how much more the child will see than an adult, or even his teacher. The child failing to see all that there is in the picture, the teacher makes suggestions in the form of statements or questions. These suggestions are as few as possible. This is "Busy Work."

Q. Give us an example of the way you begin to teach language.

A. Besides the language lessons in connection with, or rather incorporated in, each lesson of the day, there is a portion of each half day devoted to special drill in expression, — conversation lessons. It is seen at once that these lessons afford still wider scope for the exercise of ingenuity and acuteness on the part of the teacher, and are, if possible, still more interesting and beneficial to the children, since a specialty is made of describing *accurately* acts, occurrences, and things, which is a much more difficult and rare accomplishment than the description of imaginary events or things. A piece of chalk is dropped upon the floor. This is a very simple act, and it is described in a single sentence. The variety of expressions used by the pupils in such a description is surprising. These corrections are commended or a correction pleasantly suggested. I hear continually such quiet yet forcible expressions as these: "I think you can do better than that." "Try it again, and see if you don't improve." "I don't think you have done your best." "Think a minute." All the time there is an avoidance of calling names, particularly in cases of correction, so that no member of the class feels that he is *looked upon as a culprit.* Connected acts are performed and described in the same way. For instance: The teacher goes into the hall, leaving the door ajar, and returns, closing the door; passing to the pail of water, she takes a drink, throwing what remains in the dipper out of the window. Or, a little girl being asked to do something, goes to the blackboard, and standing one rubber on end, balances another on top of it; she then tumbles them down, and going to the window, looks out; then passing to her seat, she folds her

arms: a few of the children play marbles, etc., etc., — all of the class giving a description of what is done. Great pains is taken not to fall into the natural error of trying to do too much at once, which is sure to end in doing nothing. The actions are few, and the time occupied in one scene seldom exceeds three minutes. Sometimes the children sit perfectly still, and write about any noise they may hear in any given number of minutes; or, they are asked to imagine they are at home, or in the woods, etc., and are told to describe the sounds they hear, or rather imagine they hear. A very interesting exercise, too good to be forgotten, is one in which the children are told to describe something they saw on the way to school, while the rest try to think what it is; and if they fail to think, the child giving the description may tell them the first letter of its name, or give some word that sounds like it, till it is guessed. It appears to me that no one who considers the natural results of this continued training of the perceptive faculties, together with facility of expression, both oral and written, can fail to see with delight the comparative ease with which these children will master elements and principles in the broad field of investigation that lies before them. They are, indeed, *ready for anything.*

Q. When would you permit a child to write a thought?

A. As soon as a child can tell something that he has learned; then I would have him write it. The child can often give a very good oral description, when he finds much difficulty in writing what he knows. Writing insures exactness.

Q. When the children are able to write, how would you proceed to instruct them in language?

A. Natural objects were the best to be used in the instruction of children. A bird, a flower, a plant, were all great helps. Two birds brought into the school-room could be compared with much benefit by the pupils. There was nothing like comparison for developing a child's power of observation and testing its knowledge of the language. Bring the child face to face with animals, and cause it to exhaust its powers of description upon them. It should be taught *to find out everything for itself.* One excellent means of acquiring habits of observation recommended was the keeping of diaries. This induced a habit of care and a methodical way of accumulating facts. Children should be able to write down clearly and concisely what they saw. Besides the educating influence of this method, a love for natural science is aroused in the mind of the child, the benefit of which is untold. A child that loved nature possessed at least one element of salvation, and an influence which would draw it nearer to good and to God. His plan was to teach the parts of flowers, and when children required a new word to give it to them. *Accurate description* was the thing to be aimed at. Everything a child *gains, it gains for itself, of its own mental activity.* It took a child a *long time* to see a thing *well.*

He advocated the use of animals and plants in teaching children the language. Children were especially interested in animals, and a favorite way of his was to get them there to tell what they could about those they were the most familiar with.

Q. In what other way would you teach it?

A. The pupils in the lowest primary grades should invent stories, and illustrate them by drawings on the slate; they also write their thoughts, and read them before the class; as soon as an idea is gained, it is sure to find expression. All lessons given should be in part language lessons; the language part consists in constantly taking care that the forms of expression are correct, and the arrangement of words proper. The onerous drudgery of learning to spell is not necessary, for children learn a new word when a new idea demands one, and not before.

Q. Is not description a good way to acquire language?

A. Requiring pupils to describe actions is the highest kind of language lessons; all language can be taught in that way. Let them describe things; their quality, actions, and uses. As soon as they can easily write, let them describe their little parties, picnics, travels, etc. ACCURATE DESCRIPTION IS THE HIGHEST POINT OF COMPOSITION.

Q. How do you manage to teach language with pictures?

A. Each teacher should be furnished pasteboard cards, on which she shall paste pictures from pictorial papers, magazines, etc., or that the children bring to her for that purpose. The pictures should be passed, and the pupils requested to write about them. By the aid of pictures, the lessons are greatly enlivened, and much information is gained; and, at the same time, ideas are suggested which are sure to find expression, and that is what is particularly desired.

Q. How do you cultivate original composition?

A. Exactly the same thing holds true of writing. No human being can be interested in making pot-hooks, or in filling dreary copy-books with copies, but almost any one can be interested in putting his thoughts into words, if he is rightly taught. As a matter of fact, nothing seems to entertain children more, after they begin to write with tolerable ease, than to give on their slates an abstract of some story they have read, or to describe anything else that happens to have attracted their attention. Where this system of original composition has been adopted from the beginning, the classes soon acquire real ease and facility of expression; they write as they read and as they talk, — naturally.

Q. How do children learn to speak correctly?

A. Never allow a child to see a word incorrectly written. He never asked a child "Is this correct?" It should be allowed to see no incorrect words. People only learned to speak incorrectly by hearing the language spoken incorrectly. No one ever learned to avoid faults of expression by

hearing incorrect language given them to translate into correct language. Children should also be trained to know when they are wrong. They should be taught to be certain about everything they had learned.

Q. Suppose the child uses "is" for "are," how would you correct it?

A. In order to correct the habit, give him many opportunities to use it correctly.

Q. Is it not a good practice to permit pupils to question each other?

A. Pupils should be permitted to question each other. This is a very interesting and profitable exercise. For instance, suppose a child should read a line containing the word *adventure.* Let one pupil ask another to use it. The pupil answers, "I met with an adventure last summer." "What was it?" The pupil replies, "I had a fight with a wild-cat, and the cat got the worst of it."

Q. What does the general term "language" include?

A. The general term "language teaching" includes all the various devices for developing ideas, as well as the time and manner of furnishing the child with a vocabulary, to be used as recallers of ideas in acts of perception and conception. Such lessons include, also, the various methods for impressing indelibly upon the mind the forms of the words as a whole, as well as the analysis and the synthesis of its parts, including the training of the vocal organs in the utterance of these sounds, of which the parts of the words are to the mind merely reminders. A word is not considered learned until it can be recognized and spoken by the pupil the instant his eye covers it.

Q. Do you teach grammar from text-books?

A. No; not in the primary departments, and a limited use in the grammar departments. We train them in correctly spoken and written language, and make these prominent at every step of the pupil's progress. We train the children to observe carefully, to think accurately, and to express their thoughts readily and easily.

Q. What is your judgment of the general method of teaching grammar?

A. The present general method of teaching grammar is all wrong. If you want children to speak correctly, present occasion for thinking; let them express their thoughts in words, and when far enough advanced, let them read the science of the English language, and they will not hate grammar as they do now, while, at the same time, they will be able to speak and write more correctly. I have heard school children rattle off from memory page after page of geography, grammar, and reading, but it was all mechanical. This is not so much the fault of teachers as it is generally supposed to be. You select for school directors, gentlemen who apply to the education of the young a system that has been handed down from the traditions of our English forefathers. These directors say: "This method made my ancestors great men. See what it has made us." They don't seem to think that this is a progressive age.

## GEOGRAPHY.

*Question.* How would you begin to teach geography to children?

*Answer.* The moulding-board is used in teaching geography, for all the forms of relief, and the contour of the continents. In short, the teaching is *objective; ideas* are acquired from the object of thought by the children, and they are led to *a correct expression of them.*

Q. Would you require the child to memorize the definitions in the geographies?

A. No. Teach geography, as far as possible, by observation; when you cannot teach all of the land and water divisions by observation, deal with the imagination. Let them see the hill, slopes, range, chain; if no hills are near, use the moulding-board. A stereotyped definition of a hill, valley, or a plain is of no use to a child; he may easily commit the words to memory, and not acquire one new idea.

Q. How do you teach geography in the grammar schools?

A. The recitations in geography in the grammar schools are sometimes thus conducted: A miniature wagon containing sand is wheeled before the class, and the subject of the lesson practically illustrated by what may be called world-building. Suppose the subject is Africa. Teacher and pupils outline the continent, heap up mountains in one place, scoop out valleys in another, draw the lines of the water-courses, locate cities, deserts, capes, until the real Africa seems to lie in little before them. They search with Livingstone for the sources of the Nile; they push their way with Stanley across the "dark continent."

Q. What are the barriers in teaching geography?

A. We, ourselves, lack the ideas, and what we fail to understand we fail to impart to others.

Q. How long would you keep a class in elementary geography?

A. One year is sufficient in elementary geography as a preparation for the building up of continents.

Q. Should drawing maps precede moulding?

A. The drawing should succeed moulding; do not strive for perfect maps. Use squares or outlines for groundwork.

Q. What is the measure of the child's geographical knowledge?

A. The child's experience is the measure of everything he knows.

Q. Tell us about world-building.

A. Let me describe the work of a teacher: Now, it would seem that every teacher ought to know the one proper way of studying and reciting a lesson on Africa. But this teacher evidently did not. Instead of that, she wheeled before the class what looked like a miniature express-wagon, upon it a pile of sand, and with this sand she began to play with these

big boys and girls. The game seemed to be a sort of world-building. For the waters were gathered together in one place, and the dry land of Africa appeared; and certainly a very beautiful, tell-tale likeness of Africa it was. Then the mountains were raised up, both in the east and in the west, joining towards the cape, and between them appeared the great deserts, and streams began to flow from the mountains, and joined to form great rivers; *real* rivers, *real* deserts, *real* capes, *real* mountains those; and strange to say, those boys and girls seemed to know all about them, and to act over anew the drama of creation with delight so intense as if the original God-image of their souls had not long since been destroyed by original sin. And now they made the waters bring forth abundantly moving creatures; and the earth, cattle, creeping things, and great beasts; the dry land, herb and tree, all after the genuine African kind; they people the coast; they built great cities; they founded empires; a band of young philosophers, they tried to discover the causes of the desert and of the annual inundation of Egypt; a band of young explorers, they searched with Livingstone for the sources of the Nile, and they were lost with him; and so many young Stanleys, they pushed their way through the "dark continent," and found him. Not one child, of course, that was not thoroughly absorbed in doings like these, — and this weird play they had the audacity to call a lesson in geography.

Q. Should you study a continent before a state?

A. The general features of a continent should be studied before those of a state. It becomes easier to study a state afterwards.

Q. How would you begin to teach the idea of a continent?

A. First find out all that the child has for a foundation, and from this teach him to observe elementary forms. Let the child tell you all he knows. Let him use the sand, blocks, form, for hours. Train him to observe things in the open field. Give them liberty to see at random; afterward, lead them to combine and classify.

Q. How would you begin the study of a continent?

A. Build it up in the imagination. Let it be the product of the senses. It is a good means of cultivating the imagination.

Q. What do you mean by study of a continent?

A. The study of a continent is the framework in which the detail, or local geography, can be placed. The facts accumulate, and gradually the framework is filled in, — it is the groundwork.

Q. How would you proceed to impress the whole?

A. The clearness and distinctiveness of the whole depends on the clearness of the parts. The study of elementary geography is the study of parts, separate structures; the child should see the mountain slopes.

Q. Would you teach mathematical geography in primary grades?

A. Mathematical geography can be taught successfully only in the high school. "The pure in heart shall see God."

Q. Do you not think it is a good plan to teach geography by comparisons?

A. Yes. When the second continent is made, compare it with the first. Compare in relation to its physical features, contour, minerals, vegetables, and animals; its shelter, food, clothing, advancement, etc.; its rain-fall and snow.

Q. What is the great unit of division of the continent?

A. The highlands, — analyze the highlands.

Q. What determines the character of a continent?

A. The form.

Q. What determines the shape of a continent?

A. Its elevation. The elevation determines the life products; they determine the climate.

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## NUMBER.

*Question.* How would you teach number?

*Answer.* Begin with a number that the child knows. Teach all there is to this number before passing to the next.

Q. How would you teach number from one to twenty?

A. It should be taught so thoroughly as to be recalled automatically.

Q. Would you teach number abstractly at first?

A. All the elementary facts in arithmetic should be entirely learned from objects. All rules, definitions, and processes should be discovered by the pupil himself. The end of education (and this is an important thing) is not the acquisition of knowledge, but the development of the mind.

Q. How is a knowledge of numbers and their relation gained?

A. 1. A KNOWLEDGE OF NUMBERS and their relations is gained in the same way as a knowledge of color, form, size, or weight. The ideas of of which *red*, *square*, *large*, and *six* are the signs, are taken (abstracted) from objects. What these words (red, etc.) are to the mind depends entirely upon the products of sense-perception, and no amount of study of signs alone will ever bring the slightest knowledge of the things they represent. Signs may be learned without a definite association with the ideas that they should recall; they are learned, in fact, and the learning of figures and not numbers — signs, not things — is the fundamental mistake in teaching arithmetic.

2. A NUMBER CAN BE SEPARATED INTO EQUAL OR UNEQUAL PARTS. EQUAL OR UNEQUAL NUMBERS MAY BE COMBINED. NOTHING MORE CAN BE DONE WITH A NUMBER OR NUMBERS.

To illustrate: Present a number of marks, thus, | | | | — the sign is 4. Present the same objects thus, | | | |. The relations *seen* may be expressed, "In four I see two and two," "I see two twos," "Two marks and two marks are four marks," or "Four marks less two marks are two marks." The two relations of separation and combination are *seen together;* they are reciprocal; one suggests the other; one cannot be thought without the other is known, either consciously or unconsciously. Therefore, the teaching of one relation is greatly aided by the teaching of the other at the same time.

3. THE COMBINATION OF NUMBERS IS ADDITION; of equal numbers is MULTIPLICATION. The separation of a number is SUBTRACTION; the separation of a number into two equal parts is DIVISION; the separation of a unit into equal parts gives FRACTIONAL UNITS. *All* that belongs to pure arithmetic has for its foundation, root, and source, the simple putting together and putting apart numbers of things.

4. PLANTS AND NUMBERS SHOULD BE TAUGHT BY PRECISELY THE SAME METHOD. First, the whole plant or number is observed; then the parts *on* the plant or number, or severed from the whole; afterward the plant or number is to be compared with all other known plants or numbers.

Grube simply extended the method of object-teaching to teaching of numbers of objects.

5. THE PROPER WAY OF TEACHING LANGUAGE IN NUMBER PRESENTS A COMPLETE AND LOGICAL ILLUSTRATION OF THE MANNER IN WHICH ALL LANGUAGE SHOULD BE TAUGHT.

Ideas are gained from objects. When an idea becomes by sense-perception a *clear idea*, it *demands* expression. From repeatedly seeing and handling three blocks, three marbles, three sticks, etc., there comes into the mind the idea of which three, 3, or III is the sign.

The relation of two or more ideas — a thought — is seen again and again. When this thought is clear, it of itself demands expression by a sentence. To illustrate: supposing the idea and signs 3, 2, 5 to be already known, then the repeated observation of these objects | | |, | |, ▱ ▱ ▱, ▱ ▱, ⊥ ⊥ ⊥, ⊥ ⊥, * * *, * *, thus arranged, awakens the thought expressed by the sentence, "Three and two are five." The very important law is, teach clear ideas first, then their signs; teach relations of ideas, and then the sentences which express them.

We can express that only which is clear in the mind; it is dangerous to *force* expression of that which is dim; lead to clearness before any attempt at expression is demanded. *Ideas grow very slowly, and the most important part of a teacher's duty, after presenting the proper opportunities for the growth of ideas, is to* WAIT *and* WATCH.

Pupils should be allowed to express their thoughts in the idioms which

they have been using all their lives. The early introduction of terms, phrases, and sentences entirely foreign to their minds, such as "divided by," "multiply," "subtract," "taking one number from another," "taking one number so many times," is disastrous; for such forms cannot, for a time, contain a child's thoughts. The child should be slowly led to these expressions by permitting it at first to use its own words, and slowly make the new forms known by association and repetition.

Q. How long should objects be used in teaching number, to produce sense-products?

A. It is difficult to tell; it may cease at ten.

Q. How far should a child go in number the first year?

A. A child cannot be taught more than ten the first year.

Q. How would you proceed with number lessons?

A. In number lessons, I would have the child *tell* how he performed a problem, and the next time he *writes* it, and then he has a rule subject to the changes which later experience suggests.

Q. Would you have the examples solved without the use of figures?

A. Have the pupil illustrate everything. Have the examples solved without figures.

Q. Should facts be learned?

A. All facts should be discovered by the child. Do not *force* an inference.

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## HISTORY.

*Question.* Give us an idea of your method of teaching history.

*Answer.* For example, let the topic be "Sir Walter Raleigh and the first Settlement in Carolina." After sufficient study, I would request the pupils to write, in a letter to their friends, what they know about it. I would give them forty or forty-five minutes to write upon the subject. Such a method would produce genuine interest in the study, and develop language.

Q. How is the recitation in history conducted?

A. The methods by which this most desirable result is obtained cannot be given in full here, but they may be suggested. The recitation in history is thus conducted: Each pupil writes, in the form of a letter to a friend, all he knows concerning a certain topic, as, for instance, the settlement of Montreal. This is not only an exercise in composition, but in penmanship, orthography, punctuation, capitalization, and letter-writing. The mistakes are afterward pointed out and corrected, and the pupil, if apt, soon learns to write page after page correctly at first draft. The pen is used as freely by the student as the tongue in ordinary schools.

Q. What is the foundation for remembering and understanding history?

A. We teach geography, first, as the foundation for remembering and understanding history; second, to understand the adaptation of the earth's forms and phenomena to life; third, as the proper beginning of the study of the normal sciences. We try to teach history so that pupils may form a great liking for reading in this direction, and that they may acquire a method by which they can take in the great leading facts of history.

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## PENMANSHIP.

*Question.* How do you teach writing?

*Answer.* We begin by writing familiar words on the blackboard, which the child copies as a whole on his slate. Then little instances, in which those words appear, are constructed on the board and carried off, and thus the child proceeds. Further on, the letters themselves are taught, beginning with the letter "i," then to "u," and "w," and so on. It is of great importance to teach them to write carefully from the first.

Q. When would you begin to teach the child to write?

A. Just as soon as he becomes acquainted with me and the school,—when he feels at home. Teach technical writing from the start. Begin with one letter, not with principles. Keep at it as long as you please. Technical writing is a separate exercise; it is not to be connected with copying; copying is done without, technical writing with, counting.

Q. You seem to insist upon perfect work in writing at the board by the teacher.

A. Yes; that is so. Nothing but *perfect work.* The child at first will pass in crude work, but your perfect work will soon enable the child to pass in perfect work. The subject should be taught very thoroughly in the lowest primary grades. *Continual, persistent* practice should be kept up on one letter at a time until it is *mastered.* The progress at first may be slow, but future progress will be rapid. Quality of work, not quantity, is demanded.

## SCHOOL MANAGEMENT.

*Question.* How would you open the school in the morning?

*Answer.* By reading a short selection; or, by reciting, — teacher leading, using a very low voice, — followed by chanting the Lord's Prayer in a low, sweet, and reverent tone, and by singing a pretty, childlike hymn or song.

Q. Would you teach manners and morals directly? that is, in set lectures, or incidentally?

A. I would not teach manners and morals through set lectures, but by continued daily application of the duties and attention due each other; for instance, if a class wish to enter the room, I would have the leader knock at the door, and wait until it is opened, and request the teacher to extend a hearty welcome to the pupils; for example, the teacher, on the approach of the pupils, says "Good morning, children; how do you do?" The pupils acknowledge it with a bow, and quietly pass to their seats.

Q. What would you do the first day of school?

A. In the first place, you want to grasp your little pupil warmly by the hand, to let him know that you love him. Then lead him into the school-room, not a prison-like apartment, with high, bare walls, but a nice warm room, with tinted wall-paper, plants in the windows to give it a cheerful appearance, and a desk for our little pupil, to give him individuality. Added to all these things, you must have that one great element necessary to the successful education of the young, — a good teacher. No amount of adornment will take the place of a good teacher. Now that we have our little fellow in homelike surroundings, what shall we do with him? We don't say, "Get down in that seat, or I'll whip you," but we kindly conduct him to his individual desk, and impress him with the necessity of order. Not graveyard order, for that is horrible, hypocritical, and universal; but a degree of quietness consistent with the progressive study-hall. Let the little man talk to his neighbor if he wants, and the knowledge of this privilege will prevent him from abusing it. The next thing to be done is to set his little faculties to work preparatory to developing them mentally and morally. To do this effectually, we take the child along step by step in nature's own course.

Q. How do you manage to keep children in order?

A. By good teaching and proper treatment.

Q. If you had a class of sixty, what would you do?

A. In the first place, thirty pupils is enough for any teacher; but, having sixty scholars, they should be divided into groups of ten, according to their mental calibre. One group may be at low-set blackboards, drawing, writing, etc.; another group at the block-table, building bridges,

houses, and churches; another group at the sand-table, making hills and valleys; another group at their desks, writing and drawing on their slates; and another braiding splints, weaving, arranging shoe-pegs, stringing beads, etc. Ten minutes is long enough to keep the pupils at any particular work, when a movement should be made, such as marching, gymnastics, and singing. The dull scholars should be very carefully treated with slower work, and never be made to feel that they are dull, and after a time you will find the dull boys overtaking the brighter ones. They seem to retain better because they are slow in getting it. Slow and sure is a good motto.

Q. How do you manage to keep order?

A. Order takes care of itself, if you have the attractive power.

Q. How would you secure order?

A. Order limits energy to the work of the school; that is, the best order in which the best work can be done; order is not a question of silence. The criterion is work.

Q. Tell us some means of securing order.

A. The attractiveness of the school-house, the pleasure in the work, confines the energy to the work. *All brain-work gives either pain or pleasure.* Order limits energy to the work of the school. Concentration of work is a means of securing order. That is the *best order* in which the *best work* can be done. Order is not a question of noise or silence; the criterion is work. Play is nature's method of giving work. Be sure to make the school-room and its surroundings attractive. Let the work attract. See that the work is made a pleasure. Confine the energy of the pupils to the work. Let them draw; the child has a great desire to express thought by pictures. This is a driving power.

Q. Do your teachers govern much?

A. No; the teachers give the pupils freedom, and let them govern themselves. Busy work worketh wonders. Order takes care of itself, if you have the attractive power.

Q. Would you permit communication?

A. Keep children at work, at work that they love, and communication will take care of itself.

Q. Do you believe in rigid school government in the lowest primary grades?

A. The children in the lowest primary grades should not be obliged to toe the mark and stand at a position of rest. Let them enjoy home-like surroundings, and act childlike. Teachers who "hear pupils recite," "keepers of school," might question the propriety in extending such liberties to the little ones. Teachers should pay but little attention to the changes in position, but keep busily at work, making the subject so attractive that the children will be eager to catch at everything new.

Q. Are not some means used in government, by teachers, that are questionable?

A. Yes. Continued watching on the part of a teacher to discover the weak side of the pupil; acting the part of a detective instead of a teacher; using bitter sarcasm in the presence of the school; adverting to the low standard of instruction before you took charge of the school; movements in order to express the hideousness of some childlike freak; taking names; and a score of petty things utterly unworthy the teacher. No one mean is so abominable as taking names; the pupils will hold a council of war, and openly denounce such a course.

Q. Your school-room seemed so pleasant; — how made so?

A. The teachers and pupils try to outdo each other in this particular. The board of education supply us liberally, also, with apparatus and objects for teaching.

Q. The children were not uneasy and restless. How do you prevent it?

A. We use the natural restlessness and curiosity as potent factors in sound mental growth. This is wisely directed by pleasant and earnest teachers. We keep the children busy and happy in using their own power for their own progress.

Q. We understand you. But all teachers are not pleasant and earnest. What shall *we* do?

A. We sifted out the poor teachers, — the weak ones, — and that is the *way to do it.* Our teachers are intelligent, and use tact; able to devise methods marked by their own individuality.

Q. Your teachers seemed so pleasant and the pupils so happy. Is this general?

A. We do not believe in the stereotyped expressions of too many who pretend to be teachers. Such expressions as "Pay attention," "Stop your whispering." "Go to your seat," "Stay in at recess," "Study your lesson," "Stay in and study your lesson," "You'll get a whipping," should not be heard in the school-room.

Q. How do you work to attain such homelike feeling?

A. We endeavor to adapt all instruction and criticism to the child's capacity and temperament, so that he shall never get discouraged, but become more and more confident of his own power.

Q. Do you approve of keeping children in at recess?

A. No.

Q. Would not too much work produce disquietude?

A. If the struggle to do is too great, if there is weariness, the character of the work as a whole is wrong. Sometimes the voice produces wearisomeness. Oh, the constant annoyance of a terrible voice! Again, the mannerism of the teacher, dress, — all these have a tendency to make or unmake a school. The power to do, — singing, drawing, writing, read-

ing, — the work of the teacher, is an incentive; the child sees the work, and says, "My teacher can do it; so can I."

Q. Do you think that little children should be trained to work silently?

A. I do not advocate a graveyard stillness in school. Oh, the hum of busy work! Precision when restrained is abuse.

Q. I saw the children in the lowest primary grades run to their seats. Does not this cause disorder?

A. Oh, no; this is natural; it pleases the little ones, and they like it; and really it is productive of good order.

Q. Do you believe in corporal punishment?

A. Corporal punishment is a weakness; a teacher may do well that manages a school with it, but he *does better* who manages a school *without it.* Teaching is an art. It is said that teachers are born, not made; — we have made ours. With the rational teacher, discipline takes care of itself. We give the children a great deal of freedom, and they work up to good order.

Q. What will banish corporal punishment?

A. Corporal punishment is a substitute for the weakness of the teacher. If the will is governed by reason, — not unreason, such as moods, troubles, sorrows, — the order of the school will be looked upon as a means, not an end. The teacher should go to the school-room in good, high health. If you are cross, stop teaching; if you are sick, let the children do the work. Rational teaching will banish corporal punishment from the school-room. Have the courage to stand up and work. *Courage is quietness; bluster is weakness.*

Q. Do you give any attention to physical culture?

A. Yes. Physical culture receives attention. We believe that the moral and mental natures may be entirely changed by neglect of the body. Every child not deformed by nature, — and even those deformed, — may be benefited by proper exercise. I would have daily exercises in physical training, and would pay special attention to the way in which the children stand and walk. The change in the bearing of children should be noticeable.

Q. Would you give much attention to military movement in school?

A. Just enough to insure a correct carriage of the body, and perfect step in marching. I would have the pupils pass *in* and *out* to music.

Q. What means of recreation do you furnish?

A. In nearly all the Quincy schools the children sing fifteen minutes each day. This furnishes a pleasant means of recreation, improves the voice materially, aids the instructor in the teaching of reading, and, what is of far greater importance, is beneficial as an aid in securing to the children health.

Q. Do you practise physical exercises?

A. Daily physical exercises are held in all the Quincy schools, under charge of a competent teacher. Special regard is given to the way in which the children stand and walk. Prizes have been given to the best schools, and also to the best individual gymnasts in some of the schools, thus inducing a healthy rivalry among teachers and children that has resulted in much good.

Q. How would you manage a stubborn boy?

A. The will should be guided by reason, not unreason. Do not magnify the faults of the pupils. Give them the right way, and they will forget to do the wrong way, because they take pleasure in doing what is right. The studies of school can be made a constant delight. For instance, reading may be made a constant delight by the pictures behind the words. Reading, alone, may be taught so as to make the child hungry for reading.

Q. How do you manage to keep the slates in a cleanly condition?

A. Each child uses a sponge to erase the matter on the slate. All slates are erased at the same time. This should be made a playful exercise, and let the children work at it vigorously.

Q. What books should the teachers read?

A. First, study psychology in Porter, Hamilton, and Spencer. Master the subject of sense-perception before you take any other step. Read Joseph Payne's "Lectures on the Science of Education"; "Lectures on Teaching," by J. G. Fitch; Tate's "Philosophy of Education"; Garvey's "Human Culture"; Spencer on "Education"; and kindred books.

Q. Do not some teachers imitate too closely, in order to do rational work?

A. Above all, in the school-room, ask yourself at every step, "Why do I take this step? Have I a *good reason for it?* Am I doing this because I was taught so, or because my superintendent tells me to do it this way, or *because it is adapted to the nature of the child's mind?*"

Q. How would you proceed to teach morals?

A. The teacher should encourage the pupils to confess their faults; the teacher should not, by word or act, deceive the children. The roughest children may be won over on the side of right through fair dealing. The whole tendency of school work should be to elevate, ennoble, and refine, — the pupils should realize that they must be distinguished by good manners, and that good manners are the outgrowth of good morals.

Q. Tell us more about objective teaching.

A. Next, numbers are taught *objectively*, and the operations with numbers in the same way. Much attention is given to lessons which develop the power to use language as the expression of the ideas which the pupils acquire in these lessons. Writing and drawing are prominent exercises. The pupils begin to write their words as soon as they begin to

read; and they continue the daily expression of thoughts in writing. Much attention is given to teaching a good handwriting. He started with the primary schools, and made primary reading his first object; required all his teachers to teach the subject by the *objective word-method.*

Q. Do you believe in pupil-teachers?

A. Yes. You will find in all of the primary grades pupil-teachers; you will see these young women looking over the work on the slates, of their dictation exercise the day before, *not marking the child for errors*, but marking the errors of the child.

Q. How do you manage with dull children?

A. I would take half an hour each day, when necessary, to bring on a dull child, or encourage it. Emulation, and not punishment, is the power used.

Q. Should not pupils be permitted to ask questions themselves?

A. Yes. Instead of the teacher asking questions, permit the pupils to question each other; the pupils should ask such questions as will require a full sentence in reply. Pupils will ask apt questions.

Q. Can children learn, under a feeling of timidity?

A. No; not much that will remain with them. Self-consciousness must be learned; make the child feel at home, before either reading or writing is begun. Three or four months should be spent in generating power, getting the range of the child's ideas, — a sense training.

Q. Suppose a child has been absent from school, and some of the work has been omitted, what then?

A. If some of the work has been omitted, — not been done, — do it.

Q. If a child has been poorly taught, how would you proceed?

A. Don't discourage him and try too much.

Q. Why are some pupils so thoughtless?

A. Primary work should be well done. It was seldom that grammar-school teachers received classes well prepared for that grade. The purpose of schooling was to develop the mind. Sometimes teachers made an effort to teach words only, which he thought was a mistake; children should be taught to think, for only by thought could the mind of the pupil be developed. We learn to do a thing by doing it, doing it under careful criticism and direction, doing it better every time until it is done well.

Q. How long would you keep pupils at a task?

A. Pupils in the lowest primary grades should be kept at their tasks for ten minutes at a time; frequently they work, if there is pleasure in it, for a much longer time.

Q. Do you believe in concert exercises?

A. To a limited extent. They may be used to fix facts in the mind, but there is a tendency to destroy individuality.

Q. Should primary classes be heard frequently?

A. Pupils in the lower grades require less time, but greater frequency, in class exercises than those more advanced; a great deal of repetition is necessary, and at first the work proceeds but slowly. "Slow and sure" should be the primary teacher's motto.

Q. Should each day's lesson be reviewed?

A. Divide the class in sections and have them alternate. The object is to teach concentration of thought, and to avoid stammering and hesitancy. Each day review the lesson of the preceding day.

Q. Do you think it best for the teacher to mark pupils at each recitation?

A. No. It is mechanical, and nothing more than a staging process.

Q. Do your teachers resort to individual criticism?

A. Individual criticism is looked upon to be an evil, as it has a tendency to *restrain free expression of thought.* I do not believe in calling names, particularly in cases of correction. It is not best to make a member of a class feel that he is looked upon as a *culprit.* Individuality should not be *suppressed,* but *stimulated.*

Q. Do the pupils correct each other's mistakes?

A. There was no smirking of the class, no lifting of hands to call attention conspicuously to the fault. The teacher quietly wrote "instead" on the board. "How do you pronounce this word?" Class in chorus, including the delinquent, "Instead!" It was a polite way of correction, instead of hypocritical snapping up of each other's slips that makes over-righteous little critics, I fear, of some of our school children; and it was another witness to the way in which, as Miss Morse had said, "the *class* brings the duller ones along with it." As the reading proceeds,—"Put in another word for 'localities.'" Child reads the sentence again and says "place" as he goes on, without stopping, to the end. The teacher makes this synonym-exercise, I notice, at all the hard words, and the substitute is made as the reader goes on, showing that the entire paragraph is understood. Something following about the water in Holland being older than Adam, and yet the Dutchmen cannot drink it,—"Why is this? Who's Adam? Why cannot they drink the canal water?" "Because it is salt and dirty." "Can you think of any other situation in which people would have nothing to drink? Here it says, 'Water, water everywhere, and not a drop to drink.'" "*Caspian* Sea," calls out a boy, going far inland for a comparison.

Q. In written exercises of the pupil, do you mark all the mistakes?

A. No. The teacher should not mark every mistake at first, only errors that are general, and then explain all the corrections to the class. Criticisms should be adapted to the child's capacity, so that no pupil may be discouraged, but become more confident of his own powers.

Q. Would you require pupils to commit to memory pages from textbooks?

A. I would not require pupils to commit to memory pages from the text-books, without understanding them; pupils should be taught to think, and to express their thoughts correctly.

Q. When should the will-power be used?

A. When attractiveness fails, then the will should be used; always to be tempered by reason, not unreason.

Q. You insist upon absolute perfection of work. *When* and *how* are corrections made?

A. To mark every mistake would be a task; but this is not done at each exercise, nor, indeed, is it oftener than occasionally done. Ordinarily these written exercises are corrected as a whole, that is, the errors that are general, are marked, spoken of, and their correction explained to the class, and when the next set of papers are looked over these errors are looked for, and if not found, others are selected and hunted down in the same way.

Q. Suppose the pupil continues to make errors after corrections are made?

A. If an error is persisted in, the writer is spoken to personally, but as a rule, individual criticism is held to be an evil, as it has a tendency to restrain free expression of thought.

Q. About how many pupils should each class contain?

A. Minimum, thirty, in the lowest primary grades; maximum, fifty, in the highest primary and grammar grades.

Q. What is the Quincy System?

A. The Quincy System, so-called, is an attempt to apply the science of education. It is only an attempt, and compared with what can be done for children in public schools, it is far from being a complete success. The results of the work in the Quincy schools mark the transition from the old, lifeless text ways of teaching to the living way, which will develop the whole mind and the whole man. The so-called Quincy methods, learned and simply imitated, would produce a result as poor as methods which we are trying to avoid. Now to answer the question. On the one side is the nature of the mind to be developed, on the other, the nature of the subject with which the mind is to be developed. The perfect adaptation in teaching of the subject to the mind is the perfect method.

Q. What is the object of the Quincy System?

A. The object of the Quincy System is to transform the public schools from machines to living organisms; to make growth take the place of drill; to put life and soul into routine, and make the school-room a pleasure house rather than a weary prison.

Q. Do you claim that your system is new?

A. I want to say in the beginning that I present nothing new. I

have been accused of inventing a system of teaching. Systems of this character are not invented, they are discovered; and the one I speak of is as old as Adam. It is an old system, and that is one great reason why it should be universally adopted. It is old and good.

Q. Where did you begin to reform the teaching?

A. In the primary schools,—and made primary reading the first object; then required all the teachers to teach the subject by the *objective word-method;* taught reading alone,—not spelling before reading. The children learned to read without knowing the alphabet. Ideas first, then language as the expression of ideas brought in much reading besides that found in the primary-school readers.

Q. Are members of our boards of education qualified to supervise schools?

A. The greatest discovery of the last 500 years was that of a few school-committee men of Quincy, who discovered that they did not know how to superintend schools.

Q. Should the power of selecting a superintendent be vested in a board of education?

A. No objection, if intelligent men are chosen; otherwise, the superintendent better be appointed.

Q. Should the superintendent be held responsible for results?

A. The superintendent should be held responsible, but only on conditions that he gets power. The principal should say to the teacher, "I hold you responsible for real work, real results." This condition should be understood,—that the teacher be left free to work out her own salvation. The test should be general results, tested by examination, inspection, visits.

Q. Do parents appreciate good teaching?

A. It is a pleasant thing to notice the increasing appreciation of good teachers, on the part of parents who have children under their care.

Q. Should parents teach?

A. I would prefer not, because teaching is a great art, which few can master. Let parents simply keep their children clean and healthy, and leave the teaching to be done in school. Hearing recitations is not teaching, by any means. Teaching is the bringing of new ideas into the mind through objects; classifying ideas; comparing them, and combining them into creatures of the imagination. All that a teacher can do is to lead the child's mind to act, to acquire knowledge. Rote learning is simply inculcating stupidity, both in pupil and teacher.

Q. Do you approve of class criticism?

A. At Quincy, class criticism—something apart from the teacher's—was directed to substance rather than form; to ideas rather than inflections.

Q. What promotes regular attendance?

A. Means of stimulating attendance, behavior, and study, outside of real teaching, are becoming less and less necessary. The results seem to prove that the attractive influence of real teaching will render punishment and compulsion in attendance unnecessary. The moral effect of filling children's heads full of good thoughts, and their hands full of pleasant, absorbing work, is the formation of good habits of thought and action.

Q. Do you approve of requiring the children to study at home?

A. I would not require small children to take books home for study. I do not like to see children burdened with books; five hours' daily study is enough. The children, on the way to school, should act childlike, but not childish.

Q. Would you consider it a serious matter for a pupil to make a mistake?

A. No. I would not permit teachers to crush out errors, nor make a culprit of the child who makes a mistake.

Q. I saw no laughing at mistakes. Do you forbid it?

A. No. It is not a crime to make a mistake; no child is ashamed to acknowledge it, nor does he try to conceal it.

Q. Do you believe in courses of study?

A. Yes, when they give the minimum of the amount of work to be done, they are necessary as a general guide. No, when they give the maximum of the amount of work, for then they cause teachers to cram for examinations. As a whole, it is best not to conform to the course of study, nor fear superintendents.

Q. Do you approve of story-telling in school?

A. Yes. Every teacher should be a good story-teller.

Q. Are books used to any considerable extent in Quincy?

A. To this question I am obliged to make both an affirmative and a negative reply. Affirmatively, books are used, frequently referred to for the purpose of obtaining valuable information beyond the possible individual experience of the pupils. Negatively, books are as infrequently used for the purpose of obtaining that knowledge which comes *within* the possible individual experience of the child. Books which are usually termed "text-books" are seldom seen in the hands of pupils or teachers inside of the school-room. All books from which useful information can be obtained are constantly sought after by both teacher and pupil, not for the purpose of memorizing the text, but for the purpose of enabling them to absorb the ideas contained in them.

Q. I noticed that the children were able to repeat many lines of choice poetry. How do you proceed to get the results?

A. All children above the lowest primary grades learn at least four

lines of poetry each week. The teachers, without exception, enter into this with enthusiasm, and all succeed in a greater or less degree. Schools which had accomplished most with this exercise made a degree of improvement in reading and in the use of language more marked than the others. And besides being an excellent practice for the cultivation of memory, it will be a source of much pleasure to the pupils in future years.

Q. Some teachers as they grow old become cross. Do you think that such persons are fit for teaching?

A. No. The teacher should ever be young, and take delight in child-like sports. Be a child with the child, see how it grows, and grow with it.

Q. What should a pupil accomplish in a grammar school?

A. When the child leaves the school, he should be able to read well and understandingly, at sight, ordinary reading; speak the English language correctly; write a letter in a neat, rapid, and legible hand; perform any arithmetical problem he would be likely to meet in practical life; and be able to think and reason.

Q. Have you means of ventilating your rooms?

A. No modern means. I would throw open the doors and windows at recess and at night. While the doors and windows are open during the day, I would immediately put the pupils through some physical exercise.

Q. Do you mark pupils for "what is perfect recitations"?

A. All work done upon the slate is inspected by the teacher, and commended in proportion to its merit. No permanent record of merits and demerits is kept during the first year, but, when inspecting the slates, the teacher marks a slate which shows but indifferent effort on the part of a child, with a stroke of a blue crayon; those which show a reasonable effort, she marks with the "silver mark," or white crayon; and an unusual effort is honored with the "gold mark," or a stroke of the yellow crayon. This quiet method of indicating approval excites eager anxiety on the part of the children.

Q. Into what two general divisions do you divide the work of the teacher?

A. Into *training* and *teaching*. Training leads to the formation of correct and skilful habits of mechanical execution, as seen in the reproduction of all forms of language, writing, phonic analysis, spelling, use of capital letters, and punctuation. The products of training are secondary and subordinate aims of school work; most of them are simply means to an end, — means of learning well.

Q. What order of talent is required for teaching?

A. There is no place, always excepting the nursery, where one is called on for the active display of so many varieties of talent and ability as in the school-room. There is no person, except the mother, who needs

to be so capable, so accomplished, so consummate in methods as the teacher. These two — the mother and the teacher — make the scholar, the orator, the statesman, the theologian, the man, the woman. They take the tender, pliable, budding nature, and surround it with circumstances best suited to its individual development. For each child has a nature of its own, and requires special treatment. As the florist gives to each plant the soil, the warmth, the moisture, the stimulus, the sun, the shade; as he prunes it at one time, and at another allows it to flourish in wild luxuriance; so the mother, the teacher, adapts to each child, according to its development, to its needs, the special culture and treatment suited to it, changing this from time to time as the child changes.

Q. Granting scholarship, what feature should be prominent in teaching?

A. Ingenuity of the teacher is one of the best features of school work. The teacher should be left free to invent new ways of interesting pupils.

Q. Is not the majority of teaching mechanical routine work.

A. Teachers should not stop at the books placed in their hands. It should be their greatest pleasure, as it certainly is their highest privilege, to point out to their children the books to read at home, and thus to give that invaluable lesson which is now so seldom learned, — how to go alone. Nothing can be done, however, so long as school remains the victim of routine. Immense buildings, costly apparatus, multitudes of studies, formal parade and show do not make good schools or good scholars. That school is good in which the work is done intelligently and with interest. That school is bad in which the work is superficial, unintelligent, or dull.

Q. What is the difference between *a* teacher and *the* teacher?

A. He thought there was a vast difference between a school-keeper and a real teacher. The one was always at a stand-still, while the other was continually growing.

Q. Do not the primary teachers attempt to teach too much?

A. All good things were of slow growth, and usually the slowest growth was the fastest in the long run. Object-lessons were condemned as pernicious and repressive. Too much was required of the child, and the facts given them by the teacher were often confusing. There should be no repression or set way of teaching.

Q. Do not the teachers make the work too difficult?

A. Teachers should not make a difficulty for the pupil. If they make a difficulty, and lead the child into it, and cannot get him out, they are to blame.

Q. Should freedom be granted to teachers in imparting instruction?

A. Yes; give teachers freedom to choose what they please. Poor teachers will cut their own throats with freedom; good ones will save themselves. Throw all the responsibility of action upon the teacher.

Q. Do you hold teachers to a rigid manner of doing work?

A. There is much freedom and ease in the conduct of the school exercises. The children are orderly, but perfectly at ease in the expression of thought and feeling; and they are happy in their work. The teachers have the opportunity, and are required to carry out normal principles and methods; and this in all the schools.

Q. Should teachers be required to instruct children before they know what to do?

A. No; don't ask teachers to put anything in practice until they see and understand it.

Q. Should the superintendent instruct his teachers?

A. Yes; the superintendent should give lessons in the class-rooms, and frequently call all the teachers of one grade together, and *teach* and *train* them how to teach.

Q. How should he proceed to instruct the teachers?

A. Take up one point at a time, — the most important, — and work it up; start it before taking up a new one.

Q. Do you practise holding teachers' meetings?

A. A large number of meetings for the instruction of teachers have been held. The teachers, one and all, are indefatigable students of the science and art of teaching.

Q. Would you have long meetings?

A. No; short meetings, and many of them.

Q. Would you make it obligatory, on the part of teachers, to attend?

A. Optional in attendance.

Q. I saw no mechanical teaching. Tell us how to do away with it.

A. The teachers have been trained to do the work; they know how to teach; they do rational work; the teachers breathe life, growth, and happiness into their work.

Q. You ignore text-books. Will not that make teaching difficult?

A. That modern ideas should be bitterly resisted by many teachers trained under old ideas is natural. They worship the text-book as a resource in time of trouble, and do not know what to do if they are called on to rely upon themselves. Yet no text-book, however good, can give what must be given to make teaching effective. Instruction depends for all its vitality and for all its vigor on the life and power which the teacher can put into his talk. Without that, the best of books must be dull to school-children; the most carefully digested course must become mere humdrum routine. There is no public question of more interest and of more importance. The schools do not do the work they might; they do not fill the place they should. The expense at which they are carried on is crushing. More will not be given until more is demanded by the public; and to arouse public interest and call public attention to the school

question as it now stands is the best service that can be performed for popular education.

Q. Suppose some teachers are not progressive, how would you proceed?

A. Put your work where it will do the most good; help the teachers who help themselves, let the others alone.

Q. Should worthless teachers be kept in school?

A. If the superintendent is strong enough with the committee, he should weed out the worthless teachers. Worthless teachers are elements of weakness, — only weakness. Many a comparatively poor teacher may be made good, and even excellent, by training and judicious advice. Educate and weed. Old teachers are the worst; God alone can "change their hearts."

Q. Why do some teachers fail to teach thoroughly, even when well grounded in the principles of teaching?

A. Teachers often dissipate their power by too much charge; they do not give sufficient drill or repetition.

Q. Your teachers seemed uniformly kind and ladylike; how brought about?

A. Teachers should be very kind to the little ones, and always be kind. Harshness and brutality should never be exhibited by the teacher. If a child is unrestful, the teacher should approach it and tenderly place it in its proper position. Kindness should be the rule of the school and even the law of management. The children should be made as happy as possible. The teacher should be so true and kind as to be able to break up all rowdyism, profanity, and wrong-doing.

Q. Are not some teachers too self-conceited? Does not the teaching make one so?

A. Self-conceit is a fault. Study to find out your faults; have a critic.

Q. Should a teacher blunder?

A. A teacher must have the courage to blunder.

Q. If you had a class of sixty little children, how would you manage to teach them?

A. You ask, "If I had a class." I wouldn't teach so many. You may be obliged to do it, but it is wicked, — yes, it is cruel. Thirty little children are enough, even for a skilful teacher. Group them; group the children according to their ability and power to pay attention, with eye and ear being the test. Do not let them know that one division is higher or lower than another; tell them they are all in the same grade. Groups run into classes. In the second year it will not be necessary to group.

Q. Some of the children are so young that we don't know what to do with them.

A. Set them to making something, — if nothing more than making block houses.

Q. My pupils do not advance equally. Am I to blame?

A. One child has inborn qualities, and needs but little light, — he will advance in spite of the teacher; the other is dull, and what is light to the other child is darkness to him, — he needs extra drill and training, and the point must be repeated until a sufficient number of aggregations are gathered in his mind to make a permanent impression.

# III.

# LECTURES ON THE SCIENCE AND THE ART OF TEACHING.

# LECTURES ON THE SCIENCE AND THE ART OF TEACHING.

## READING.

I. Preparation for Reading. 1. Biography of the author. 2. Getting the sense of the sentence. 3. Getting the sense of the subject. 4. Giving the sense. 5. Telling the sense.

Biography. *a.* Early life: birth, childhood, youth, manhood. *b.* Later life: preparation, occupation. *c.* Characteristics.

How to get the Sense of the Sentence. *a.* Ask questions about the sentence. *b.* Let the pupils translate what they read. *c.* Let the pupils infer the meaning of words from the context. *d.* Let the pupils use the word correctly.

How to get the Sense of the Subject. *a.* Converse with the pupils. *b.* Let the pupils mention the principal object, and the prominent facts concerning the object. *c.* Compel the pupils, by means of questions, to *think*, to *reason*, and to express the thoughts fully, understandingly, and logically.

How to give the Sense.— *General Principles.* *a.* All words expressive of ideas *new* to the subject are *emphatic.* *b.* Words used in contrast to a *preceding* term are emphatic. *c.* All words suggestive of *unexpressed* antithesis are emphatic. *d.* All words expressive of ideas, not new to the context, are *unemphatic.*

Characteristics of Unemphatic Parts. *a.* Any word or thought necessarily implied is *unemphatic.* *b.* Any word involved in the context is *unemphatic.* *c.* Any word or thought already stated is *unemphatic.* *d.* Explanatory words are *unemphatic.* *e.* Repeated words are *unemphatic.* *f.* Words are *unemphatic*, also, through: 1. Anticipation; 2. Sequence; 3. Subordination. *g.* What is well known or understood needs no emphasis.

Telling the Sense. *a.* Let the pupils reproduce the thoughts read and acquired, orally and written, in their own language. *b.* Discussion.

INFLECTIONS OR SLIDES. *a.* The rising slide is associated with what is *incomplete* in sense, doubtful, interrogative, supplicatory, untrue, uncertain and negative ideas. *b.* The falling slide is associated with what is *complete* and *independent* in sense; whatever is positive, exclusive, dogmatical, mandatory, true, certain, etc. *c.* Sincere, honest, simple ideas, should be read with the simple slides. *d.* Jesting, sarcasm, ridicule, scorn, irony, etc., should be read with the compound slides.

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Every recitation wherein the pupil reads anything should be a reading lesson, or exercise in voice culture, to teach distinct and natural utterance.

Gradually introduce punctuation marks, one at a time, mastering it fairly before taking another.

As early as possible, let pupils copy their lessons in script.

Keep prominently in view, that the purposes of reading are to *acquire* and *impart* knowledge.

Let there be intelligent and earnest interest in what is read, in order to read it well. Remember that children read best what they like best.

Appeal to the pupils' own senses of the beautiful, the good, the brave, and the spirited.

Teach pupils to *read* carefully, not only what is written or printed, but also pictures, nature, — all that meets the eye.

REMARKS. — The chief hindrance to success in teaching reading arises from the insufficient preparatory training of our teachers. The *end* of reading should be to give expression to thought and feeling; but how can we give proper and effective expression to that we do not understand?

Reading should be an exercise in thinking and expression, *a very efficient educating process.*

In extemporaneous delivery, our perfect knowledge of our own intention dictates the emphasis that best expresses our meaning; so, in reading, a clear perception of the author's aim suggests the emphasis that is expressive of the intended meaning.

The selection of emphatic words is regulated by principles which can be exactly formulated for teaching. It is an error — but still reproduced — to suppose that words are emphatic in virtue of their grammatical rank. Emphasis has nothing to do with the grammatical rank of words.

The reader should be able to bring the expression of a thought to a focus, and recognize, as applicable to the art of teaching, generally, that

"WHAT IS BEST ADMINISTERED IS BEST."

## SPELLING.

### Basis of Work for the Lowest Primary Grades.

(*a*) If we misspell a word our brain picture of it is defective.
(*b*) If wrong, we compare the written work with the brain work.
(*c*) The foundation of spelling should be, then, the reception in the brain of forms, not sounds.
(*d*) In order to retain form in the mind, the *closest* attention, and the *most energetic* exercises of the sense of sight must be brought to bear upon that form.
(*e*) The closest attention to form is attained by attempting to draw it.
(*f*) The closest attention to a word that can be given, is to draw it, that is, to copy it in writing.
(*g*) All primary study of spelling should be by copying words.

**PRINCIPLES.**

1. The forced attempt to reproduce or express that which is vague and indistinct in the mind is detrimental.
2. The child should be prevented, as far as possible, from *seeing* or *reproducing* incorrect forms.

**CAUTIONS.**

1. No reproduction of the copying at first.
2. *Never have one word written incorrectly*, if you can possibly avoid it.
3. Work carefully. "Make a difficulty and you will have it."
4. Teach the child to perceive. Trained sight will take in a word form at one seeing, so that it can be correctly reproduced with great ease.
5. Teach the most used words first.

### Reasons why the Teacher should be Cautious.

1. Incorrect forms and expressions stamp themselves as readily on the mind as correct forms.
2. Incorrect forms and expressions — which produce imperfect impressions — turn up sometimes in life's work as unwelcome intruders.

If the above points are heeded in teaching primary classes, excellent results will follow in spelling. The same will prove true of all forms and expressions; as, capitals, punctuation, and syntax.

### First Year's Work.

METHOD.

1. The first year's work (lowest primary) should be spent in copying words, with little or no reproduction without copy.
2. Every word and every sentence taught should be copied from the blackboard on the slate, and then read from the slate.
3. Let the first copyings, no matter how crude and awkward, be commended, and the writer encouraged. (They are types of the child's crude percepts.)
4. Request the child to persevere, — the better the picture of the word the child makes, the more distinct will the impression be on the mind.
5. All study of spelling should be by copying words and sentences in the *best possible handwriting*.
6. The copied words should be marked and corrected *just as carefully* as any other lesson.
7. The first year the child should be taught to express thought orally.

### Second Year's Work.

METHOD.

1. At the beginning of the second year mental pictures will be stored in the mind, and pupils may be required to reproduce them. (It is safe to begin reproduction now: the children have been taught writing technically, and are able to write a plain hand.)
2. Begin carefully. After a word has been copied from the board, erase it, and have it reproduced without copy.
3. Do the same with two words, then three, and so on, until the pupil can reproduce the copy correctly.
4. Write a sentence, erase a part of it, and then cause the whole to be written correctly.
5. Teach those words only which your pupils use in language. (This holds good throughout the whole course. By language we mean words used in any and all recitations.)
6. No word should be taught until it is a sign of a distinct idea in the mind.
7. The second year the child should talk with the pencil. (This only involves the reproduction, continually, of words which he knows.)
8. When a word is misspelled, the teacher should *at once* erase it, and substitute the correct form.
9. Keep a list of misspelled words, and teach no other words until they are learned.

Note. — Too much stress cannot be laid upon the importance of careful and correct work on the part of the teacher.

## Third Year's Work.

**METHOD.**

At the beginning of this year, if the first and second year's work have been faithfully performed, the children will write correctly most new words after reading them once.

1. Require the children to read a sentence and reproduce it.
2. Introduce oral spelling.
3. The teacher should dictate familiar sentences to the pupils to copy on slates and the board.
4. The pupils should be required to use original sentences involving the use of the word.
5. Every word misspelled should be corrected in the Exercise Book by the pupil.
6. Pupils should be required to use words in various ways before copying in the Exercise Book.
7. Give attention to the spelling of words separately and in sentences. (The best test of spelling is writing from dictation.) The writing of words and sentences helps reading essentially, and if it were done for no other purpose, the time would be well spent, — time which would otherwise be given to listlessness or tiresome idleness.

## Fourth Year's Work.

**HOW TO PREPARE THE SPELLING EXERCISE.**

1. In the Book for Primary Departments, the pupils should be required to copy the words, and sentences that follow them, on the slates many times before the recitation, giving attention to the proper spelling, correct use of capital letters, and punctuation-marks. (T. write words on the board.)
2. For the *dictation exercise* the teacher should write the words on the board beforehand, and require the pupils to study them, and write sentences containing them; the words should be erased from the board, and the teacher should then dictate a sentence containing one of the words. Pupils write the sentence in this book.
3. For the *original exercise*, the teacher should write the words on the board before the recitation, and require the pupils to write many sentences illustrating the use of the words; the words should then be erased, and the teacher should pronounce one of the words at a time, and require the pupil to write an original sentence containing the word.
4. The teacher should develop the exercises in drawing which the pupils are to draw upon their slates; and, after the corrections are made, copy in the book.

5. Keep constantly in mind the three steps through which the pupils must pass — the *copying* step, the *memory* step, and the *mastery* step — in spelling.
6. Let every exercise bear upon the correct use of language.
7. GIVE UNDIVIDED ATTENTION TO THE THOUGHT AND ITS PROPER EXPRESSION.

DIRECTIONS FOR THE SPELLING EXERCISE.

1. Use pen and ink if the pupils are provided with desks.
2. Require the pupils to write the words neatly as soon as pronounced.
3. Construct each letter according to the models given.
4. Pupils check misspelled words.
5. Permit no erasures, insertions, or writing over of letters or words.
6. Pupils write the corrected words at the bottom of the page.
7. When a pupil fails to write a word, a blank should be left.
8. All blanks, letters, or words erased, inserted, written over, or written illegibly, should be counted as errors.
9. Pronounce the words only once.
10. Ascertain if all the members of the class have faithfully attended to the checking and the rewriting of the incorrect words.
11. Have occasional exercises — say twice a week — in dictation. Dictate sentences *once only.* Mark wrong, if there is a single mistake in punctuation, capitals, or words. Use blank speller, or slips of paper.

REMARKS. — The incorrect words can be corrected by the pupils as a part of the same exercise, or reserved for further study and drill, and re-written as a special exercise. The spelling blanks should be kept in the possession of the teacher.

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## LOCAL GEOGRAPHY.

PREPARATORY.

SUGGESTIONS.

(*a*) In teaching beginners, general observation is not sufficient.
(*b*) Knowledge must descend to minute detail.
(*c*) Lead the pupil to observe the natural scenery about him, and acquaint him with it.
(*d*) Begin to observe these at the point where he is most familiar.
(*e*) So teach that the terms will cease to be mere words, and offer him realities.
(*f*) Put the child in possession of the terms by which these are denoted.

RIVER.
- 1. Banks
  - 1. Steep
  - 2. Sloping
  - 3. Flat
  - Earthy. Rocky. Grassy.
- 2. Water
  - 1. Dark
  - 2. Clear
  - Deep. Shallow. Flowing. Eddying.
- 3. Channel
  - 1. Level
  - 2. Sloping
  - 3. Pebbly
  - 4. Rocky
  - Broad. Narrow.
- 4. Course
  - 1. On the slope of the country.
  - 2. On mountain spurs.
- 5. Bed
  - 1. Smooth
  - 2. Rough
  - Sandy. Pebbly. Rocky.
- 6. Source, Head, Rise
  - 1. Springs
  - 2. Lakes
  - 3. Glaciers
  - Continuous. Intermittent.
- 7. Length
  - 1. Configuration.
  - 2. Area.
  - 3. Character of the soil.
- 8. Mouth. Deposits, deltas, basin.
- 9. Cataract. Precipice.

So teach geography that it may be *understood* by the children, so that it may *interest* them and *remain* with them, and form the *subject of future thought.*

**HOW TO TEACH LOCAL GEOGRAPHY.**

1. Talk with the children rather than to them.
2. Present the idea by illustration rather than by description.
3. Show the objects in nature, or have models of them, or pictures of them.

REMARKS. — Knowledge is not power to the child, if it be abstract. Every class of facts, and every principle involved, should have illustration from the wide range of nature. Every sense and power of the child can be grasped and applied in the teaching of geography.

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## GEOGRAPHY.

### STUDY OF HILLS AND MOUNTAINS.

I. ELEVATIONS OF LAND
- (*a*) Hills, — high or low.
- (*b*) Mountains
  - Steep or gentle
  - Earthy or craggy
  - High or low.

II. PARTS OF HILLS AND MOUNTAINS . . . .
- (*a*) Base.
- (*b*) Foot.
- (*c*) Summit.
- (*d*) Side, slope, or slant.

III. CONSTRUCTION OF HILLS AND MOUNTAINS . . . . . .

- (*a*) Single
- (*b*) Group
- (*c*) Chain
- (*d*) Range
- (*e*) Peak
- (*f*) Systems

A hill or mountain may be bare or covered with

- Grass.
- Heath.
- Shrubs.
- Trees.
- Snow.

IV. FORMS OF LAND SURFACE . . . . . .

- (*a*) Level or flat, — *plain.*
- (*b*) Uneven or undulating, caused by the elevations and depressions, forming *valleys.*
- (*c*) Plateau.
- (*d*) Mountainous.

V. BENEFITS DERIVED FROM MOUNTAINS . .

- (*a*) Mountains intercept moist currents; the cold summits condense the moisture; the moisture is precipitated in the form of rain, hail, and snow.
- (*b*) Mountains supply springs and rivers with water.
- (*c*) Mountains contain abundant mineral treasures.
- (*d*) Mountains add to the healthfulness of a country.
- (*e*) Mountains add to the beauty of the landscape.
- (*f*) Mountains render the earth habitable.
- (*g*) Mountains are promoters of civilization.

DIRECTION. — After the pupils get the correct ideas, then they should repeat together the names of the several parts, and subsequently *describe* each part individually. During the second and third years the teaching should be confined to the *description* of the terms used; in the third year the definitions should be developed by the pupils, — aided when necessary by the teacher, — and committed to memory.

### DEFINITIONS OF THE TERMS DEVELOPED.

1. A natural elevation of land rising above the surrounding country is called a *hill.* (The term *hill* is applied to ridges less than 2000 feet in elevation. Over twenty and less than 500 feet, low; over 500 feet, high.)
2. A natural elevation of land, rising above the level of the earth and the hills, is called a *mountain.* (Over 2000 feet and less than 5000 feet, low; over 5000 feet, high. Earthy mountains means composed of earth; craggy, of rocks.)
3. The bottom of a hill, or a mountain on which it stands or rests, is called the *base.*
4. The lowest part of a hill or a mountain is called the *foot.*
5. The highest part of a hill or a mountain is called the *summit.*

6. The surface between the base of a hill, or of a mountain, and the top, is called the *side*, *slope*, or *slant*.
7. A single elevation standing alone is called a *hill* or a *mountain*.
8. A number of hills or mountains standing together is called a *group*.
9. A series of hills or mountains connected, or following each other in succession, is called a *chain*.
10. A line of hills or mountains is called a *range*.
11. The top of a hill or mountain ending in a point is called a *peak*.
12. An entire collection of mountains, including groups, chains, ranges, and peaks, is called a *system*. (Valleys also may be included in a mountain system.)
13. Land quite flat or level is called a *plain*.
14. Rolling land, rising or falling like waves, is called *undulating*.
15. Land enclosed between hills and mountains is called a *valley*.
16. A broad area of land in a somewhat elevated position, skirted by mountain ranges, is called a *plateau*.
17. A portion of country full of mountains is called *mountainous*.

### How to Teach the Children about a Hill and a Mountain.

1. In developing the ideas, use the natural objects, or models.
2. Begin the study of topographical geography with the accurate observation of the locality in which the instruction is given, thus carrying out the Pestalozzian principles of *proceeding from the known to the unknown*. Consider the eminently *educative* character of this course, and the natural process of the development of the child which is implied in it.
3. Lead the child in such a way as to teach him to observe with *precision* and *accuracy*. A necessary condition to all valuable results is *attention;* attention is easily secured, because the instruction is directed to matters which he can *understand* and which interest him; his memory will be healthfully exercised, because the instruction concerns *things rather than words*.
4. Do not teach the usual verbal geographical definitions until the children have acquired a clear perception of the terms they describe.
5. Teach the child to observe. Much attention should be paid to accuracy of language in describing the different appearance of land and water. The terms used should be *thoroughly* explained, and *repeated* until they become *impressed upon the memory*.

Questions asked the pupils in giving the lessons objectively: —

### Elevations of Land, Parts of Hills and Mountains.

1. If you were to walk across the school-room or play-ground, could you do it easily?

2. Have you ever found it more difficult to walk in other places? Why?
3. On what part of a road can a horse draw a cart the more easily?
4. What kind of land is that on which it is easy to move along?
5. What kind of land is that on which it is more difficult to move?
6. What difference may we say there is in the land? By the teacher. Sometimes a large extent of land is flat. We call such land a *plain.*
7. If I talk to you about a plain, what would you understand the word to mean? Answer by pupils: "A large piece of land that is quite flat and even is called a *plain.*"
8. What name do you give those places at which land rises up? Answer. *Hills.*
9. When do you call the land a hill?
10. When the land rises higher than a hill, what do we call it?
11. What part of a hill or mountain do we first come to as we walk towards it?
12. When you go up a hill or mountain, where do you begin to ascend? Answer. At the *base.* You may call that part of the base at which you begin to ascend the *foot* of the hill.
13. Point out to me some other part of a mountain. *Sides.* What is that part called that we walk over between the base of the hill and the top? *Sides.*
14. Point out to me some other part of a mountain. *Top.* Teacher. This is called the *summit.* What part of a mountain would you call its summit?

NOTE. — The teacher may now propose that the children should help to describe a walk up a mountain, naming the different parts over.

### FORMS OF LAND SURFACES.

1. What do we call elevated portions of land?
2. What do you call a mountain standing alone?

   NOTE. — Mountains seldom stand alone.

   Teacher builds up with loam a number of hills. Children examine and make models out of clay, or illustrate on the board.
3. What do you notice of the mountains?
4. What is a number of mountains standing together called? *Group.*

   Teacher builds up a set of mountains of which one joins another. Asks the pupil what they are called.
5. What do you call mountains joined together? *Chain.*
6. Wherein does a chain differ from a group of mountains?

   Teacher builds up lines of hills and mountains. Asks the pupils to observe accurately and describe them.
7. What is a line of hills or mountains called? *Range.*

8. Wherein does a range differ from a chain?
9. What is the top of a mountain ending in a point called?

   Teacher builds up single mountains, groups, chains, ranges, and asks pupils to observe and describe.
10. What is such an entire collection called?
11. In which of these places, a plain, mountain, or valley, would it be most pleasant to live in? *Valley.* Why?

NOTE. — A plain is cold in winter and hot in summer, because it is open to the cold winds and hot sun. It has no mountains or trees to afford shelter.

12. What is meant by undulating surface?
13. Wherein does a plain differ from a plateau?
14. With what are plateaus generally skirted.

### BENEFITS DERIVED FROM MOUNTAINS.

1. Why is the moisture precipitated?
2. How is it precipitated?
3. How do mountains supply springs and rivers with water?
4. Why do mountains add to the healthfulness of a country?
5. Why do mountains render the earth habitable?
6. Why are mountains promoters of civilization?

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## STUDY OF CONTINENTS.

The study of geography should not be limited to a single description of the earth and of the beings on it; it should describe, it should interpret, it should compare, it should rise to the *how* and the *wherefore* of the phenomena which it describes. Physical geography, therefore, ought to be, not only the description of the earth, but the physical science of the globe, or the science of the general phenomena of the present life of the globe, in reference to their connection and mutual dependence.— *Guyot.*

| | |
|---|---|
| ANALOGIES OR REMARKABLE COINCIDENCES IN THE STRUCTURE OF THE FORMS OF THE CONTINENTS . . . . . | (a) That the southern points of all the continents are high and rocky. (Seem to be the extremities of mountain belts.) — *Foster.*<br>(b) That the continents have, east of their southern points, a large island, or a group of islands. — *Foster.*<br>(c) That there is a deep bend of their western side toward the interior of the continent. — *Foster.*<br>(d) That the lands expand and come together towards the north, while they separate and narrow down to points in the south. — *Steffens.* |

**Analogies, etc.**

(*e*) That there is a singular parallelism existing between the two sides of the Atlantic Ocean, — the salient angles of the one corresponding to the re-entering angles of the other. — *Humboldt.*

(*f*) That the great terrestrial masses are grouped two by two, in three double worlds, united by an isthmus, — on one side of the isthmus is an archipelago, on the opposite side a peninsula. — *Steffens.*

(*g*) That the lands are more numerous in the northern hemisphere, and that the water covers nearly the whole of the southern hemisphere. — One is called the Continental or Land hemisphere, the other the Oceanic or Water hemisphere. — *Carl Ritter.*

(*h*) That the lands are combined in two great masses, giving them a marked character of originality. In the Old World the mass extends from east to west; in the New World from north to south. — *Ritter.*

**Contour of the Continents**

(*a*) Some continents are deeply indented, giving great length to coast lines; other coasts are simple and without numerous indentations.

(*b*) Africa has no important peninsulas, nor anywhere lets into the continent the waters of the sea.

(*c*) Asia has many large peninsulas, and it is washed on three sides by the ocean.

(*d*) Europe; contour is varied, being deeply indented in all parts by the ocean, and by inland seas.

(*e*) North America has prominent indentations on the northern, eastern, and southern coasts, but few on the western.

(*f*) South America has a few indentations on the western coast, — no prominent ones.

Note. — Africa is closed to the ocean; Asia opens only its margins; Europe is the most accessible of all the continents; North America stands next to Europe, and South America corresponds to Africa.

## General Suggestions to be Observed in Teaching the Structures of the Continents.

(*a*) Either hang an outline map of the world before the class, or draw the different continents on the board.

(*b*) Ask the pupils to observe the resemblances of the continents, and then the differences.

(*c*) See that the pupils thoroughly understand what is meant by the *contour* and the *relief* of a continent: the *contour* of a continent or an island is the delineation of the line of contact between the lands and the horizontal surface of the ocean; the *relief* of a continent or an island is its elevation as a whole, varied by plains, table-lands, mountains, and valleys. A knowledge of the *contour* assists

the pupil to determine the projections and the indentations of a continent; a knowledge of the *relief* of a continent is of the *utmost* importance,—controlling its drainage, shaping its river basins, directing the course of the rivers, and influencing, to a certain extent, the direction and the character of the winds.

(*d*) See that the pupils understand why modern geographers assert that there are six continents. The reasons given by Humboldt and Ritter are as follows: There are certain grand features common to six of the land divisions,—a peculiar combination of mountain systems, plateaus, and plains. In each of the six divisions of land there is, upon one side of the centre, a great mass of elevated lands, constituting the primary feature, called the *primary* axis of its structure; on the opposite side is found a similar, though smaller and less elevated mass, constituting the secondary feature, called the *secondary* axis. Between the *primary* and the *secondary* elevations is a central depression, common to the six continents.

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## MATHEMATICAL AND PHYSICAL GEOGRAPHY.

### The Earth.

I., II., III., IV., and V. taught from maps, in connection with map-drawing.

- I. Position
  - 1. *Latitude and Longitude.*
  - 2. *Relative*
    - 1. With respect to other bodies of land.
    - 2. With respect to other bodies of water.
- II. Shape . .
  - 1. *General form.*
  - 2. *Coast outline*
    - 1. Indentations
    - 2. Projections
      - 1. Northern Coast.
      - 2. Eastern Coast.
      - 3. Southern Coast.
      - 4. Western Coast.
- III. Size . .
  - 1. *Relative*, as compared with other bodies of land.
  - 2. *Length* and *width.*
  - 3. *Area.*
- IV. Physical Relief .
  - 1. *Highlands*
    - 1. Plateaus
    - 2. Mountains
      - 1. Systems.
      - 2. Ranges.
      - 3. Peaks.
  - 2. *Lowlands*
    - 1. Plains.
    - 2. Valleys.
- V. Inland Waters.
  - 1. *Lakes*
    - 1. Salt
    - 2. Fresh
      - 1. Uses
        - 1. As yielding fish.
        - 2. For navigation.
  - 2. *Rivers*
    - 1. Systems
    - 2. Main streams
    - 3. Tributaries
      - Length, size, and description of particular rivers.
    - 4. Useful for
      - 1. Navigation.
      - 2. Water-power.
      - 3. Yielding fish.

- VI. CLIMATE
  - 1. *Temperature.*
  - 2. *Moisture*
  - 3. *Salubrity*
    - 1. Healthfulness, or
    - 2. Unhealthfulness
      - 1. Latitude.
      - 2. Elevation.
      - 3. Presence and direction of mountain ranges.
      - 4. Nearness to the ocean.
      - 5. Land and sea winds.
- VII. VEGETATION . .
  - 1. Of the Torrid Zone
  - 2. Of the Temperate Zone
  - 3. Of the Frigid Zone
    - Wild and cultivated.
- VIII. ANIMALS
  - 1. Of the Torrid Zone
  - 2. Of the Temperate Zone
  - 3. Of the Frigid Zone
    - Wild and domestic.

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## HISTORICAL GEOGRAPHY.

- I. RACES OF PEOPLE . . . .
  - 1. *Primary*
    - 1. White,—European
    - 2. Yellow,—Asiatic
    - 3. Black,—African
  - 2. *Secondary*
    - 1. Indian
    - 2. Malayan
    - 3. Australian
  - Regions inhabited by each.
- II. SOCIAL AND INTELLECTUAL CONDITION . . . . . . . .
  - 1. Savage.
  - 2. Nomadic.
  - 3. Civilized.
- III. CIVIL AND SOCIAL ORGANIZATIONS . . . .
  - 1. *Governments*
    - 1. Republican.
    - 2. Monarchical
      - 1. Absolute.
      - 2. Limited.
  - 2. Religions
    - 1. Christian.
    - 2. Jewish.
    - 3. Mohammedan.
    - 4. Other.
- IV. INDUSTRIES . .
  - 1. *Leading Occupations* . .
    - 1. Agriculture, including grazing
    - 2. Mining
    - 3. Manufacturing, including lumbering
      - Natural regions adapted to the pursuit of each.
    - 4. Commerce
      - 1. Foreign.
      - 2. Domestic.
  - 2. *Cities*
    - 1. Manufacturing
    - 2. Commercial
      - Location and natural advantages.
- V. INTERNAL IMPROVEMENTS
  - 1. *Railroads*
    - 1. Local railroads.
    - 2. Trunk lines.
  - 2. *Canals.*
  - 3. *Navigation*, on lakes and rivers.

## ARITHMETIC.

The study of arithmetic should secure the following results: —

FIRST. *Mental Discipline.*
SECOND. *Accuracy and Expertness.*
THIRD. *Preparation for Business.*

**PRINCIPLES.**

1. THE PUPIL MUST ACQUIRE ACCURATE AND CLEAR PERCEPTIONS.
   (*a*) The teacher must have accurate perceptions and conceptions of the truth.
   (*b*) Nothing should be presented beyond the comprehension of the pupil.
   (*c*) The teacher should present all operations and principles objectively.
   (*d*) More attention should be given to the study of *processes* than to analysis, — *computation* comes *first*, then calculation. After pupils become expert in computation, greater attention should be given to calculation, — the thinking.

2. THE TEACHER MUST HAVE A DEFINITE PLAN OF DOING THE WORK.
   (*a*) Vague, indefinite, and incorrect perceptions of the real, the true, produce mental disorder and weakness.
   (*b*) Begin with the simple, and couple it with the difficult.
   (*c*) Insist upon the correct reading and understanding of the problem.

3. SEE THAT THE PUPIL'S ATTENTION IS CONCENTRATED, — MIND IS DEVELOPED AND STRENGTHENED IN PROPORTION TO THE EFFORT PUT FORTH.
   (*a*) The teacher must avoid doing the pupil's work, — mental growth is attained through *self*-effort.
   (*b*) Arouse every power of the mind to its fullest activity.

**GENERAL SUGGESTIONS.**

1. See that facts are presented to the mind through the same sense.
2. Associate the sum with the characters, rather than with the name of the characters.
3. The assistance rendered by the teacher should be indirect, — let it be done through questioning.
4. See that the process (the operation) is not confounded with the reasoning for performing the operation.

5. The processes of arithmetic are both analytic and synthetic, hence analysis precedes synthesis.
6. Accustom the pupil to state each point clearly, and in logical order.
7. In the grammar departments require pupils to write out the analysis of two or three problems daily.
8. After each fact has been fully developed, *review, review, review* (particularly in the primary classes).
9. See that the pupils acquire a correct and practical knowledge of business language and business practice. *Hold the pupil personally responsible for correct work.*

NOTE. — See that the tables of decades and of decimations are taught thoroughly in every grade. Take five or seven minutes each day in general drill. Make the pupils accurate and expert in mathematical *computation* and *calculation.*

TABLE OF DECADES AND OF DECIMATIONS.

| | | 1st. Dec'n. | 2d. Dec'n. | 3d. Dec'n. | 4th. Dec'n. | 5th. Dec'n. | 6th. Dec'n. | 7th. Dec'n. | 8th. Dec'n. | 9th. Dec'n. | 10th. Dec'n. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| I. | Decade. | 0, | 1, | 2, | 3, | 4, | 5, | 6, | 7, | 8, | 9, |
| II. | " | 10, | 11, | 12, | 13, | 14, | 15, | 16, | 17, | 18, | 19, |
| III. | " | 20, | 21, | 22, | 23, | 24, | 25, | 26, | 27, | 28, | 29, |
| IV. | " | 30, | 31, | 32, | 33, | 34, | 35, | 36, | 37, | 38, | 39, |
| V. | " | 40, | 41, | 42, | 43, | 44, | 45, | 46, | 47, | 48, | 49, |
| VI. | " | 50, | 51, | 52, | 53, | 54, | 55, | 56, | 57, | 58, | 59, |
| VII. | " | 60, | 61, | 62, | 63, | 64, | 65, | 66, | 67, | 68, | 69, |
| VIII. | " | 70, | 71, | 72, | 73, | 74, | 75, | 76, | 77, | 78, | 79, |
| IX. | " | 80, | 81, | 82, | 83, | 84, | 85, | 86, | 87, | 88, | 89, |
| X. | " | 90, | 91, | 92, | 93, | 94, | 95, | 96, | 97, | 98, | 99, |
| XI. | " | 100, | 101, | 102, | 103, | 104, | 105, | 106, | 107, | 108, | 109. |

## LANGUAGE LESSONS.

The primary object of education in language is to learn to use language. The use of lanugage is an art; and we learn the art by imitation and practice. The pupil who has always heard good language will use good language; his ability to use good language does not depend upon his knowledge of grammar, but upon his having heard good English, and read it.

The fundamental principle of language lessons is, that pupils are to be taught the practical use of language by the use of language, rather than by a study of its principles. They must learn the art, and, through the art, come up to the science.

[We do not wish to condemn the study of grammar, — the teacher should understand it. Technical grammar is the study of the science of language, and it belongs in the advanced course.]

The object of language lessons is to teach the art of correct expression; of grammar, to teach the science of language.

The language lessons should prepare for, and lead up to grammar. According to this principle, a knowledge of language should precede a knowledge of grammar.

### Suitable for Beginners.

DIRECTIONS.

I. 1. Require pupils to write the names of objects.

2. Require pupils to write the names of parts of objects.

3. Require pupils to write the names of qualities of objects.

4. Require pupils to name the uses of objects.

II. 1. Require pupils to give a name that will apply to everything which they can perceive (matter).

2. Require pupils to classify the different kinds of matter (mineral, vegetable, animal).

3. Require pupils to name things that belong to the different classes.

III. 1. Require pupils to write the names of objects with the name of action, forming a sentence.

2. Lead pupils to an idea of a sentence, as asserting something of something.

3. Develop telling or declarative sentence, asking or interrogative sentence, commanding or imperative sentence, and feeling or exclaiming sentence.

4. Teach them that each sentence begins with a capital letter; that a declaration or imperative sentence ends with a period; an interrogative sentence with an interrogation point; and an exclaiming sentence with an exclamation point. (Drill them in writing sentences, and correcting sentences which violate these rules.)

5. Have them write sentences introducing adjectives, adverbs, pronouns, etc. (The teacher will give the words and have them form sentences. Of course the pupils are not to know anything about these words as parts of speech.)

6. Show the difference between particular and common names, and teach the use of capitals for particular names. Teach also the use of capitals I and O. (Have them write exercises involving these things, and correct sentences which violate their correct use.)

IV. 1. Give two words, and have pupils write sentences containing them; give three words to put in a sentence; four words, etc. (Let the pupils select words which they are to write in a sentence.)

2. Give pupils sentences, with words omitted, and require them to insert the correct words. (The teacher should select and prepare a large list of such sentences, write them on the board, or take a copy from the copygram.)

V. 1. Present an object to the pupils; let them examine it and describe it. (Let them describe one another.)

2. Present objects to the pupils; let them compare and tell the resemblances and differences.

3. Let the pupils look at a picture and tell what they see in it; reproduce it orally and written. (The teacher should call the attention of the pupils to the objects, number, appearances, etc., if unnoticed by pupils.)

4. Tell or read something; have them repeat what you have said in their own words, and then write it out on their slates or on paper. (They will see that writing a composition is merely telling in writing what they know and can tell in talk.)

5. Call out the pupil's knowledge of an object by asking questions about it, and then have him write down what has been said, in full sentences. (Ask questions about a sponge, about dew, rain, water, snow, winds, habits of animals, plants, etc.)

VI. 1. Teach the use of the hyphen, as connecting compound words, and also its use at the end of a line, in connecting one syllable with the syllable beginning the next line.

2. Teach the use of the comma, as placed after the name addressed, and also as connecting three words of a series; as, "Jane, come here;" as, "He saw a boy, a girl, and a man."

3. Teach the use of the period after abbreviations, and drill pupils on the common abbreviations; as, Mr., Dr., Rev., Hon., Esq., LL.D., Ph. D.

4. Teach the use of quotation marks.

5. Teach the use of a colon before a quotation, as follows, As he said: "Mr. Speaker, the gentleman is mistaken."

6. Teach the use of the apostrophe in denoting possession, as, Minnie's book; also its use in denoting omission of letters, as, ne'er, 'tis, etc.

VII. 1. Give related simple sentences, and require pupils to unite them into compound sentences. Thus, "Mary is studying," "Mary is walking," changed into "Mary is studying and walking."

2. Give the pupils a proverb, and have them write out an explanation. "It is hard for an empty bag to stand upright." "Birds of a feather flock together." "A rolling stone gathers no moss."

3. Require them to express sentences in different ways; as, "The birds sing sweetly in the spring of the year," changed to "In the spring of the year, the birds sing sweetly."

4. Change poetry into prose. (Write a stanza on the board, and have them express the same thing in prose.)

5. Exercise them daily on misused words and in correct constructions; as, "I done it;" "Me and her done it;" "I and John saw it;" "Let Mary and I go out;" "Between you and I."

VIII. 1. Teach them how to write a letter; as, the heading, address, salutation, introduction, body of the letter, close, superscription, punctuation, and the correct use of capital letters.

2. Require pupils to write letters of different kinds, as business letters, social letters, notes of invitation, notes of acceptance, notes of condolence, excuses for absence, receipts for money, due bills, notes, etc. (It is a good plan not to receive an excuse from a pupil unless it is written in his own hand; it will teach him how to construct sentences.)

3. Let them write letters to the teacher, to the trustee, to a friend, to their parents, schoolmates, etc. (Teacher must give pupils the correct form as a model, and drill thoroughly upon it.)

4. Have them write little newspaper paragraphs, as an account of a fire, of a party, of a runaway, of a railroad accident, etc.

5. Encourage the pupils to commit to memory and recite choice selections of prose or poetry. (This will develop a literary taste.)

6. See that the pupils are interested, and give suitable subjects, and require them to write short compositions. Encourage the timid. Lead them to write naturally. In the outlines presented, the teacher should make the exercises very complete. Do not be afraid of having too much under each head.

CAUTIONS.

1. Make haste slowly in language.
2. Give variety to the lessons.
3. Let every exercise bear upon the correct use of language.
4. Do not place a text-book in language in the hands of pupils at first.
5. Correct kindly and gently, and strive to make them love to write.

### What to Avoid in the Use of Words.

1. Avoid ignorance. *a.* Common errors. *b.* Ungrammatical expressions. *c.* Incorrect articulation.

2. Vulgarity.

> "Immodest words admit of no defence,
> For want of decency is want of sense."

3. Affectation.

### How to Cultivate the Command of Words.

1. Constant use of the dictionary. 2. Make words a special study. 3. Read only best authors. 4. Seek the company of the cultured. 5. Have good thoughts to express. 6. Study synonyms. 7. Translating from one language to another.

"I had rather speak five words with my understanding, that by my voice I might teach others also, than ten thousand words in an unknown tongue." — 1 Cor. 14 : 19.

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## COMPOSITION.

Definition. — Composition is the art of expressing our ideas and thoughts in words.

Importance. — *a.* It prepares pupils for success in life's work. *b.* It affords valuable culture to the mind. *c.* It cultivates exactness in expression. *d.* It becomes a source of the most refined and exquisite pleasure.

Errors in Teaching Composition. — *a.* Subjects too difficult and abstract. *b.* Requiring pupils to write without any instruction on the subject. *c.* Making it a monthly exercise instead of a daily one. *d.* Putting words together mechanically, without any idea of their meaning. *e.* Performing the work as an allotted task, without any interest. *f.* Requiring pupils to express ideas on a subject when they have no ideas to *express.*

Sources of Material. — 1. Observation. 2. Reading. 3. Discussion. 4. Reflection.

*Observation.* — *a.* Objects of the material world. *b.* Causes, effects, etc. *c.* Experience of others.

*Reading.* — *a.* To obtain facts, ideas, sentiments. *b.* To obtain productions from master minds. *c.* To cull fine passages, write them, and commit to memory. *d.* To take note of interesting and important facts. *e.* To familiarize yourself with authors, their writings, opinions, judgments. *f.* To digest and assimilate, — make the thoughts your own. *g.* To gain seed-thoughts that will produce other thoughts in abundance. (Read *extensively*, *read* and *re-read*, *write* and *re-write.*)

*Discussion.* — *a.* To excite interest. *b.* To break up artificial training. *c.* To cultivate independence. *d.* To develop originality and individuality. *e.* To dissipate stupidness and insipidity. *f.* To teach pupils to think for themselves.

*Reflection.* — *a.* To think in order to learn to write. *b.* To evolve thoughts for ourselves. *c.* To cultivate a reflective and creative cast of mind. *d.* To inquire into the reason of things; to search for *causes* and *effects.*

WRITING A COMPOSITION. — 1. Subject. 2. Matter. 3. Analysis. 4. Amplification.

*Subject.* — *a.* The teacher assigns the subject to the pupil. *b.* Pupil select and insert topics for themselves. *c.* Subject should be adapted.

*Analysis.* — *a.* Make an outline. *b.* Let it be logical.

*Amplification.* — *a.* Present facts in an orderly manner. *b.* Sentences clear and correct. *c.* Style suited to the subject.

*First.* — Introduction.
*Second.* — Subject Matter.
*Third.* — Close.

GENERAL DIRECTIONS. — 1. Require pupils to use paper of uniform size. 2. The subject should be written at the top of the page on the middle of the first line. 3. Leave a blank between the heading and the composition. 4. Leave a margin on the left-hand side of the page, to allow for corrections. 5. The first line of each paragraph should be indented about one inch. 6. Writing neat and legible. 7. Signature on a line below the close of the composition, near the right-hand edge. 8. Composition folded neatly. 9. The name of writer, the subject, and date on the back of the composition.

CORRECTIONS. — 1. Promptly handed in on time, for corrections. 2. Corrections, as a rule, to be made by the teacher. 3. Corrections include orthography, punctuation, use of capitals, hyphens, apostrophes, construction of sentences, etc. (Severe criticism at first may discourage young writers.) 4. Indicate errors rather than correct them. 5. Draw a line under each error, and indicate the error by a symbol in the margin. 6. Pupils copy in a composition book the corrected composition.

READING COMPOSITIONS. — *a.* Let the compositions be read by one of the pupils. *b.* Appoint an editor, and have the composition copied into a paper, to be read before the school. *c.* Let the paper contain items of news, amusing incidents, wit, humor, poetry, advertisements, notices, marriages, etc. *d.* Let the school be resolved into a literary society, with regular officers, programme of exercises consisting of inaugural address, orations, recitations, essays, answers to referred questions, etc.

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## WORDS.

"Like words made magical by poets dead,
Wherein the music of all meaning is
The sense hath garnered, or the soul divined;
They mingle with our life's ethereal part,
Sweetening and gathering sweetness evermore,
By Beauty's franchise, disenthralled of time."

—*Lowell's Cathedral.*

What does Emerson call words? Ans. "Words are fossil poetry." What does Mirabeau say of words? Ans. "Words are things." What author has expanded the thought into a volume? Ans. William Mathew, Richard Grant White. What is Wordsworth's definition of a word? What objection to saying that a word is the vehicle of thought? What play in Shakespeare contains these words: "I thank thee, Jew, for teaching me that word"? Ans. *Merchant of Venice*, Act IV., Sc. 1. "Not a word? Not one to throw at a dog." Shakespeare, *As You Like It*, Act I., Sc. 3. By whom were these words used: "But yesterday the word of Cæsar might have stood against the world"? Ans. By Mark Anthony in reply to Brutus, in *Julius Cæsar*, Act III., Sc. 2. What is Hamlet's advice on gesture? Ans. "Suit the action to the word, the word to the action." Which is the more important, the study of words or of thoughts? Should we be careful of our words?

> "O many a shaft, at random sent,
> Finds mark the archer little meant;
> And many a word at random spoken,
> May soothe or wound a heart that's broken."

"Words are living powers." "Words bear the stamp of greatness, or of degradation, of glory or shame."

> "Words are mighty, words are living;
> Serpents, with their venomous stings,
> Or bright angels, crowding round us
> With heaven's light upon their wings;
> Every word has its own spirit,
> True or false, that never dies;
> Every word man's lips have uttered
> Echoes in God's skies."

Which are of greater value, words or deeds? Ans. "Words are women, deeds are men."— *Herbert.*

"Words are the daughters of men, but things the sons of God."— *Dr. Johnson.*

What character in Shakespeare exclaims, "Words, words, words!"? Ans. Hamlet.

What poem has for its leading thought the force of words? *The Poet*, by Tennyson. Can words fully express the meaning?

> "I sometimes hold it half a sin,
> To put in words the grief I feel;
> For words, like nature, half reveal,
> And half conceal the soul within."

> "To those who know thee not, no words can paint!
> And those who know thee, know all words are faint."
> — *Hannah More.*

"No words suffice the secret soul to show,
For truth denies all eloquence to woe."

"Farewell!
For in that word, — that fatal word, — howe'er
We promise — hope — believe — then breathes despair."

Is a word ever lost? See "Ninth Bridgewater Treatise," by Mr. Babbage, and Chaucer's "House of Fame." Is grief sometimes too deep to be expressed in words?

"Give sorrow words; the grief that does not speak,
Whispers the o'er-fraught heart, and bids it break."
— *Macbeth, Act IV., Sc.* 3.

"How forcible are right words," yet "a word fitly spoken is like apples of gold in pictures of silver." — *Solomon.*

Whence did Adam get words to name the animals? Should we use the simplest words?

"When you doubt between words, use the plainest, the commonest, the most idiomatic. Eschew fine words as you would rouge; love simple ones as you would native roses on your cheek."

"Simplicity is beauty; simplicity is power."

"Learn the value of a man's words and expressions, and you know him. He who has a superlative for everything wants a measure for the great or small." — *Lavater.*

"It is with words as with sunbeams, — the more they are condensed, the deeper they burn." — *Southey.*

"The fool hath planted his memory with an army of words." — *Shakespeare.*

"The world is satisfied with words; few care to dive beneath the surface." — *Pascal.*

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## GENERAL DIRECTIONS TO THE TEACHERS.

1. See that the pupils become familiar with the tools of measurement, and are able to make application of them, — a knowledge of definitions and formulas is useless apart from experimental acquaintance.

   LET THINGS THAT HAVE TO BE DONE BE LEARNED BY DOING THEM. — *Comenius.*

2. All spelling should prepare for composition, — talking with the pen or pencil.

*Requisites.*

(*a*) Pupils should be taught to copy from the blackboard with perfect accuracy words and sentences.

(*b*) Pupils at the end of the first year in school should be able to reproduce the words and sentences taught.

(*c*) Write words and sentences to be copied in bold, distinct, and large letters.

(*d*) Let the written exercise be confined to the child's vocabulary.

(*e*) Let the pupil read what he writes.

3. As soon as the child can tell something he has learned, permit him to write it.

NOTE. — Children take an *intense interest* in what they *see* and *tell* for themselves.

HOW TO GET THE CHILDREN TO TALK.

(*a*) Do something and ask the children to tell what you did; let them write it.

(*b*) Show an object and let the children tell something about it.

(*c*) Show objects and let the children tell their differences, then their resemblances.

(*d*) Pass pictures; pupils write about them.

(*e*) Read some interesting story, and let the children report it in writing.

NOTE. — Let the children read each his own, and all judge who has told the story well. Let the children grasp the story in its fulness, and narrate it in their own language.

4. Never receive poor work.

*How to prevent it.*

(*a*) If the pupil makes the least mistake, erase the word; or better, erase the whole sentence.

(*b*) Erase all work that is not the pupil's best attempt; let them learn to do good work by doing it, by doing it until it is right, until it is *well done* by every pupil.

(*c*) Be very cautious about individual criticism; it has a tendency to repress free thought. Let criticism cease to be the work of a detective. Do not seize upon every violation of law and magnify the pupil's mistakes. Rather let the advice be that of a friend seeking to make the child a law unto himself.

(*d*) Try and make each pupil confident; confidence begets success.

(*e*) The teacher should *inspect* and mark every mistake, making, as a rule, no comments; if the same mistake is made frequently, quietly advise the pupil about it.

5. See that children gain the new knowledge before taking up additional work.

## DEFINITIONS.

I. Postulate. — That the object of a definition is to tell what a thing is.

II. Deduction. — Knowledge must go before the definition. *a.* Develop the correct idea, then give the technical term (in primary grades). *b.* See that the definition is clearly understood: first, ask *searching* questions about it; second, if necessary illustrate by objects, pictures, drawings, etc. *c.* In reading let the meaning be inferred from the context, rather than commit a definition to memory. Let the pupil see that a definition, instead of preceding a lesson, as it often does, should be the conclusion of a lesson, or of some definite part of it; it is not the giving of additional knowledge, it is the summing up, a general truth, an abstraction, a deduction.

III. Cautions. — *a.* After the definitions are thoroughly understood, *see that the pupils memorize them.* *b.* Teach your pupils to think, to reason, rather than *imitate* or *repeat.* *c.* See that they *understand* subjects, rather than *memorize* books.

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## ETIQUETTE.

It is important to form good manners and correct habits in youth.

**DEFINITION.**

*The recognized forms of good breeding prescribed by good society; respect for one's self, as well as respect for others.*

**OBJECT.**

*To train pupils to form right habits of action.*

**METHOD.**

1. To teach pupils to be uniformly polite.
2. To inspire pupils to *put down* their own faults, instead of trying to *put down* one another.
3. To do something toward making all whom we meet happy.
4. To express due deference to superiors.
5. To encourage pupils to confess their faults.
6. To cultivate a spirit of forgiveness.
7. To teach pupils that people need all the kindness they can get from others in this world.
8. To not offend, — this being the first step towards pleasing. "The small, sweet courtesies of life" are doubly dear to young people.

Let your pupils realize that they must be distinguished by good manners, as good manners are the outgrowth of good morals.

"A knowledge of etiquette is a knowledge of the customs of society at its best. There is no one who may not be instructed in some points that it is for his advantage to know."

"The first years of a man's life are precious, since they lay the foundation of the merit of the rest. Whatever care is used in the education of children, it is still too little to answer the end."

"Manners and morals are indissolubly allied, and no society can be good where they are bad."

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## ORAL EXAMINATIONS.

### Standard of Examinations.

The standard should be upon work presented by the teacher as completed. The *test* in every subject should be *quality* of work, not *quantity.*

### Reading.

(*a*) Lowest primary grades should be examined on the blackboard, in the vocabulary presented by the teacher.

(*b*) Close attention should be given to the habit and power of getting thought, before expressing it orally. The habit of giving the thought just as the reader would talk should be the criterion.

(*c*) In the First, Second, and Third Readers, reading should be selected that the pupils have never seen; the pupils should be able to get thought readily, and express it easily; pupils should be able to tell why capital letters and punctuation marks are used.

(*d*) In the Fourth and Fifth Readers, reading should be selected that pupils have never seen (corresponding to the grade of work), and they should be able to give the sense of the passages, and the subject; should also be able to assign a reason for emphasizing and inflecting certain words.

### Language.

(*a*) In the fifth and fourth grades, primary department, the test should be the ability to describe actions, pictures, and objects, and tell what they have read orally; also, be able to correct the common mistakes in speech.

(*b*) In the third, second, and first primary grades the test should be readiness to describe pictures and objects accurately, giving attention to spelling, capital letters, penmanship, punctuation, and neatness of work; also, ability to correct errors in speech, and to give examples of the telling, asking, commanding, and emotional sentences.

(*c*) In the grammar classes, pupils should be required to write on a subject impromptu, giving attention to all of the above points in divisions (*a*) and (*b*); be able to correct grammatical mistakes, and give reasons for the same; write the different kinds of sentences, and tell what terminal points should be placed after them; also, analyze sentences, and parse the words; define the parts of speech, and write sentences illustrating their use.

### PENMANSHIP.

(*a*) *Classes:* Single letters in their order; also, capital letters; analysis of the same by all classes, except the fifth grade primary departments.

(*b*) In the highest primary and grammar classes, pupils should be required to write a verse as a specimen of work. Attention should be given to spelling, capital letters, punctuation, and neatness. *No work should be received unless scrupulous care has been taken in every particular.*

### COPYING SENTENCES. — SPELLING.

In the lowest primary grades the standard should be *absolute perfection in copying sentences from the blackboard*, the words of which (sentences) have been previously copied by the pupils. In the highest primary and grammar grades sentences should be dictated.

### DICTATION.

Teachers should keep a list of words learned by the pupils, and the sentences dictated should be composed of these words. If there is a *single failure* in spelling, capital letters, or punctuation, the sentence should be marked *wrong*. Sentences should be given but once.

Teachers should present the principal and superintendent with a list of words taught.

### NUMBER.

All the primary classes should be examined orally with and without objects. Pupils should be examined upon the work given by the teacher as already taught. The test should be readiness in writing and reading numbers, readiness and accuracy in computation, both in oral and written work.

### ARITHMETIC.

Pupils should be examined upon work presented by the teacher as completed.

All classes in the grammar department, and the highest classes in the primary department, should be examined on intellectual arithmetic. Accuracy and rapidity in computation in the lowest primary classes should be the test, and in the grammar grades the pupils should be required to

give reasons for the different steps, and solve practical problems embraced under the work as completed.

### Drawing.

In the lowest primary grades, pupils should be required to draw the different kinds of lines. The main point in these grades should be to find out if the pupils have a correct idea of the different kinds of lines.

Pupils should be required to draw simple figures from copy; in the highest primary and grammar grades, pupils should be required to draw the different kinds of lines, define them, and draw figures from dictation and from memory, and original designs.

### Geography.

In the lowest primary grades, pupils should be required to tell where objects are in the room; locate the prominent buildings and the streets; and locate and name local land and water divisions. In the highest primary classes, the pupils should tell wherein a city differs from a town or village; a county from a state; name and locate the prominent land and water divisions about the city; uses of them; tell the number of towns in the county, and counties in the state; draw a map of the city, locating the principal streets, public buildings, and draw a map of the county, and locate prominent villages and cities. In the grammar classes, pupils should be required to draw a map of the city, the county, the state, and locate and name the prominent physical features, and locate and name the large cities. Should be able to bound the state and mention its principal industries. In the highest grammar classes, pupils should be required to pass an examination upon the work presented by the teacher as completed, draw a map of the continents as far as completed, and locate the physical features.

### General Exercises.

Examinations in the lowest primary grades should be upon home, food, clothing, names of the days of the week, months of the year, names of domestic animals, different kinds of matter, and the primary colors. In the highest primary grades, the pupils should be examined upon well-known forms of the animal, vegetable, and mineral kingdoms; secondary colors; table of time; dollars and cents; measurement by inches, feet, yards and miles; general terms, as length, width, depth, area, surface, and edges; also upon the gnawers, cud-chewers, flesh-eaters, etc.; upon the bones in the human body, names and uses; muscles; circulation and respiration; and the lives of a few of the prominent men of America. In the grammar grades, pupils should be examined upon the above; also upon plants, animals, air, wind, forces, etc.

# IV.

# SCHOOL DISCIPLINE.

# SCHOOL DISCIPLINE.

## GENERAL POINTS.

### Essentials on the Part of the Teacher.

I. *The teacher must get a thorough knowledge of the subjects to be taught, —absolute mastery of them.*

How Acquired.

1. By attending first-class Public Schools.
2. By attending Normal Schools.
3. By attending Training Schools.
4. By attending Colleges and Universities.
5. By close personal application.

II. *The teacher must attain the best modern methods, and seek to acquire perfection in them.*

How Acquired.

1. By attending Normal Schools.
2. By attending Training Classes.
3. By attending Teachers' Institutes.
4. By thorough study of works on teaching.
5. By experimenting successfully.
6. By rational experience in teaching.
7. By continual thought,—closely watching the unfolding of the child's mind.
8. By studying the history of education, and experimental psychology.

III. *The teacher must love the work of teaching; must possess an absolute fondness for it, and take an eager delight in it. If this love of the work is not inborn and God-given, it*

Can be Acquired.

1. By cultivating a fondness for children.
2. By complete familiarity with the work.
3. By casting aside all thoughts foreign to the work.
4. By so working that the occupation will be pleasurable rather than painful. All school work should be pleasurable.

IV. *The teacher must create a thirst for knowledge,— a strong and eager desire on the part of the pupil to acquire learning.*

### How Produced.

*Attractive means.*

1. By singing.
2. By marching.
3. By calisthenics.
4. By drills in uniform movement.
5. By drawing pictures.
6. By illustrations.
7. By story telling.
8. By reading stories.
9. By pleasant tones.
10. By agreeable manners.
11. By neat attire.
12. By teaching objectively.
13. By teaching one thing at a time.
14. By arousing every power of the mind to its full activity.
15. By presenting facts to the mind through the senses.

*Rational means.*

1. By writing.
2. By lucid analysis.
3. By rational questioning.
4. By rational teaching.
5. By the development of clear ideas.
6. By development of thought.
7. By teaching things rather than words.
8. By the development of clear and accurate perceptions.
9. By having a definite plan of work.
10. By proceeding from the simple to the more difficult.
11. By requiring that things that have to be done be learned by doing them.
12. By topical teaching.
13. By developing mental power.

V. *The teacher must attain absolute mastery over self,—ready power to control and determine; a will-power guided by reason.*

### How Acquired.

1. By preservation of a sound constitution.
2. By cultivation of good habits.
3. By cultivation of great and unselfish motives.

4. By congenial and elevating companionship.
5. By cultivating social and devotional instincts.
6. By the exercise of careful and studied judgment.
7. By admission of errors of judgment.
8. By studying to discover our faults, and willingly hearing criticisms.

CAUTIONS.

1. See that the will is governed by reason.
2. Use authority only when attraction fails.
3. Don't let the will be governed by unreason, — such as moods, feelings, failures, disappointments, sickness, intemperance, etc.

No man is free who cannot command himself. — *Pythagoras.*

That person is of all others the most powerful who has himself in his own power. — *Seneca.*

The worst education which teaches self-denial and self-control, is better than the best which teaches everything else, and not these. — *Bacon.*

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## SCHOOL DISCIPLINE.

DEFINITION. — Discipline is that restraining influence which produces and sustains order, and prompts the pupil to diligent study and good conduct.

ORDER. — Order limits energy to the work of the school; that is, the best order in which the best work can be done. Order implies fitness of condition.

POSTULATE. — True rational discipline does away with all need of arbitrary discipline.

OBJECT. — The object of school discipline is to train pupils to *right habits* of thought and action, — to conduce to permanent well-doing.

RESULTS. — The result should be to teach pupils to govern themselves.

Two kinds of discipline are in use to-day: the *first* ruling by love, and the *second* governing by *fear.* Instead of offering bribes and using threats, the young should be so influenced in their surroundings that they may see virtue and happiness united. Both of the methods — love and fear — may be artificial and temporary. The teacher should seek from the beginning to form correct habits, and then there will be no occasion to reform bad ones.

The child should be taught that it is its duty to do right, and that it should do right because it *is* right. The teacher should not procure exertion by a bribe, because the effort is felt to be a sacrifice, and it will not be repeated without a like inducement. It is useless to *drive* a boy or a girl to work, or cause either to work through fear; the task may be done, but then there will be no heart in it, and the coercion will be resented.

There is only one way which can create a new habit of industry capable of supplanting the old habit of indolence, and that is the awakening of *pleasure* in work *for its own sake.* The teacher should make all school work pleasurable. Give a pupil a sense of pleasure in work, and idleness will be cured and the need of arbitrary discipline obviated.

If parents and teachers better understood the child's mind there would be a relief of much of the drudgery in school discipline. Under the present undeveloped condition of our knowledge of child-nature in the family and in the school, we can only approximate the desired results. In view of this, we will specifically speak of some of the causes, preventives, and correctives which may be used in order to secure more effective discipline in the schools.

## I. COMMUNICATION.

A. CAUSES.

1. Lack of teaching and training on the part of the parents.
2. Lack of wisdom on the part of the teacher.

B. PREVENTIVES.

1. By suggestion.
2. By advice.
3. By reproof.
4. By making communication unpopular.
5. By licensing communication.
6. By busy work.
7. By appealing to the pupil's intelligence.

C. CORRECTIVES.

1. Separate seatmates.
2. Restraint of personal liberties.
3. Request pupils to report their own offences to the teacher *privately.*
4. Encourage pupils to confess their faults, and forgive every offender who reports.
5. Administer punishment by a written communication.
6. Detention after school, — an extreme measure.

## II. TARDINESS.

A. Causes.

1. Lack of systematic family government.
2. Thoughtlessness.
3. Overweening sentimental indulgence on the part of parents.
4. Parents' covetousness.
5. Exacting too much of the pupil.
6. Requiring work unsuitable to the age of the pupil.
7. Impartiality.
8. Unkindness.
9. Lack of earnestness on the part of the teacher.
10. Lack of preparation on the part of the teacher.
11. Lack of promptness on the part of the teacher.

B. Preventives.

1. By pleasant and instructive opening exercises.
2. By a pleasant reception on entering the school.
3. By creating a love for study.
4. By cultivating pride in *habitual* promptness.
5. By making play-grounds attractive.
6. By introducing new plays.
7. By taking part in the plays.
8. By reports to parents.
9. By visiting parents.
10. By an exposition of the pernicious influence on the schools.
11. By retractive power of personal example.
12. By presentation of a written excuse from the parent.

C. Correctives.

1. Cessation of exercise when pupils enter the school.
2. Silent reception of the pupil.
3. Detention after school.
4. Private admonition.
5. Rebuke before the school.
6. Severe reproof.
7. Refuse admission to the pupil, — a severe measure.

## III. ABSENCE.

A. Causes.

1. Lack of interest on the part of the parent.
2. Lack of interest on the part of the teacher or pupil.
3. Lack of proper classification of the pupils.
4. Lack of rational teaching.

5. Conflict of authority.
6. Abuse of authority.
7. Abdication of authority.
8. Pevishness and fretfulness of the teacher.
9. Personal discomfort.
10. Favoritism by the teacher.
11. Parents' demand of child's services.
12. Unnecessary exposure of ignorance by the teacher.
13. Unjust accusations.
14. Lack of sympathy.
15. Backwardness in studies.
16. Improper grading.
17. A failure to understand subjects.
18. Neglect of private study.
19. Teacher not recognizing the principles of mental development.
20. Teacher neglecting to take child into confidence.
21. Improper home associations.
22. Lack of suitable garments.

B. Preventives.

1. By making school work attractive.
2. By taking an interest in the pupils' studies and plays.
3. By thorough and rational teaching.
4. By visitation of parents.
5. By weekly and monthly reports.
6. By cultivating a pride in regular attendance.
7. By uniform kindness on the part of the teacher.
8. By proper appreciation of work.
9. By earnestness of the teacher.
10. By consideration in the treatment of mistakes and faults.
11. By uniform cheerfulness.

C. Correctives.

1. Gentle rebuke.
2. Disapprobation of the teacher.
3. Extra study outside of school.
4. Visitation of parents.
5. Severe reprimand.
6. Public rebuke.
7. Suspension.
8. Expulsion, — a severe measure.

## IV. TRUANCY.

A. CAUSES.

1. Unpleasant home associations.
2. Improper home training.
3. Unsatisfactory results in school work.
4. Severe administration.
5. Lack of sympathy.

B. PREVENTIVES.

1. By making the school-room attractive.
2. By making school work pleasant.
3. By making all the exercises interesting.
4. By frequent changes in the exercises.
5. By winning to a love of knowledge.
6. By reading, or telling short, instructive stories.
7. By experiments in the elementary natural sciences.
8. By private reprimand.
9. By welcoming the prodigal on his return.
10. By visiting pupil's home.
11. By requesting pupil to reflect upon seriousness of the offence.
12. By educating the child's conscience, so that he shall regret the waste of time as a sin.

C. CORRECTIVES.

1. Severe reproof.
2. Inform parents.
3. Suspension.
4. Expulsion.

## V. QUARRELLING AND FIGHTING.

A. CAUSES.

1. Lack of moral cultivation.
2. Bad associations.
3. Uncontrollable temper.

B. PREVENTIVES.

1. By making the offence unpopular.
2. By the utter abhorrence of the offence on the part of the teacher.
3. By the disapprobation of the teacher.
4. By the disapproval of the pupils.
5. By enlarging upon the meanness of such acts.
6. By persuading of sinfulness.
7. By striving to strengthen the child's will to do right.
8. By encouraging the pupil to practice self-control.

9. By watchfulness of teacher during recesses, intermissions, and dismissals.
10. By cultivating self-respect.
11. By exciting shame and sorrow.
12. By cultivating a true sense of honor.
13. By good-natured ridicule.

C. Correctives.

1. Separation of offenders.
2. Deprivation of privileges.
3. Require offenders to play alone.
4. Severe reproof.
5. Suspension.
6. Expulsion, — extreme measure.

## VI. PERSISTENT DISOBEDIENCE AND WILFULNESS.

A. Causes.

1. Antagonism of parents to teacher.
2. Antagonism of pupil to teacher.
3. Revengefulness of teacher.
4. Revengefulness of pupil.
5. Unmindfulness of the teacher on the first appearance of disobedience and wilfulness.
6. Weakness and indecision of the teacher.

B. Preventives.

1. By not antagonizing parents.
2. By not ridiculing pupils.
3. By not using bitter sarcasm.
4. By not using harsh tones.
5. By not driving strong-willed pupils into obstinacy.
6. By repressing the bad qualities.
7. By needlessly giving pain to a pupil.
8. By unnecessary exposure of ignorance, error, or mistakes.
9. By using patience, and bringing to bear on the self-willed pupil the influence of kindness, sympathy, and reason.
10. By impartial judgment.
11. By example of the teacher.

C. Correctives.

1. Severe reproof.
2. Suspension from class.
3. Suspension from school.
4. Expulsion from school.

## VII. IMPERTINENCE AND IMPULSIVENESS.

A. Causes.

1. Neglect in early training.
2. Cultivation of evil associates.
3. Harboring revengeful feelings.
4. Physical weakness.

B. Preventives.

1. By treating pupils as human beings.
2. By recognizing the manhood and womanhood of the pupils.
3. By being uniformly circumspect in manner and deportment.
4. By refusing to listen to pupils' mutterings.
5. By entire suspension of work.
6. By developing the higher motives.
7. By cultivating the power to resist wrong.
8. By avoiding a laugh at the expense of the pupil.
9. By avoiding direct collision with the pupil.
10. By watching the will of the pupil so that it does not gain control over his reason and judgment.
11. By overlooking childlike faults and not seizing upon every opportunity for censure.
12. By teaching and training children, not merely telling them what to do.

C. Correctives.

1. Let the pupil suffer the result of his conduct.
2. Severe reproof.
3. Proper acknowledgment.
4. Summary justice.
5. Suspension of work.
6. Suspension from school.
7. Expulsion from school.

## VIII. UNTRUTHFULNESS.

A. Causes.

1. Ignorance.
2. Thoughtlessness.
3. Selfishness.
4. Cowardice.
5. Innate tendency.
6. Self-reporting.

B. Preventives.

1. By regarding all pupils as truthful until the teacher has positive proof to the contrary.
2. By encouraging full and frank confession with a remission of penalties.
3. By placing implicit confidence in pupils.
4. By telling the pupils the effects of untruthfulness, as,
   (*a*) Loss of reputation.
   (*b*) Loss of character.
   (*c*) Loss of conscience.
   (*d*) General demoralization.
5. By cultivating sentiments of honor and truthfulness.
6. By the example of the teacher.
7. By the teachings of the Bible.
8. By indication of approval when the child speaks the truth.
9. By not frightening the pupil by terrible denunciations of the anger of God against liars.
10. By cultivating a spirit of forbearance.

C. Correctives.

1. Suspension of teacher's confidence.
2. Suspension of pupil's confidence.
3. Deprivation of school privileges.
4. Severe reproof.
5. *Confession followed by acknowledgment.*

## IX. TATTLING.

A. Causes.

1. Meanness.
2. Jealousy.
3. Ignorance.
4. Selfishness.

B. Preventives.

1. By shunning impropriety.
2. By elevating and refining.
3. By the precepts of the "Golden Rule."
4. By persuading of sinfulness.

C. Correctives.

1. Refuse to notice it.
2. Disapprobation of the teacher.
3. Severe reprimand.

## X. LOUD STUDY.

A. Remedies.

1. Train pupils to study with closed lips.
2. Suspend exercises until quiet is restored.
3. Appeal to pupil's sense of politeness.

B. Punishments.

1. Reproof.
2. Show impropriety.
3. Separation of pupils.

## XI. LAUGHING.

Remedies.

1. By suspension of exercises.
2. By letting pupils laugh until weary of it.
3. Reproof.

## XII. QUESTIONS DURING RECITATIONS.

Remedies.

1. By showing impropriety.
2. By refusing to notice questions.
3. By prohibiting them.
4. Reproof.

## XIII. NOISE.

Remedies.

1. By training pupils how to *walk*, to *sit*, and to *move*.
2. By always admonishing them when a command is violated.
3. By letting pupils try again, until they do it quietly.
4. By quiet movements on the part of the teacher.

## XIV. WRITING NOTES.

Remedies.

1. By destroying notes without reading them.
2. By reading the notes, omitting names.
3. By asking for the author of the note. (As a rule, avoid public exposure.)
4. By private reprimand.

## XV. LITTER ON THE FLOOR.

REMEDIES.

1. By encouraging neatness.
2. By carefully inspecting the floor in the presence of the pupil, without making any remarks.
3. By requiring everything to be done decently, and in order.

## XVI. UNCLEANNESS.

REMEDIES.

1. By insisting that the pupils shall give proper attention to sanitary conditions.
2. By permitting pupils to leave the school-room, to be admitted when in proper condition.
3. By visiting parents and finding out the cause.
4. By sending pupil home, — stating cause.
5. The neat attire of the teacher.
6. By habitual attention to the cleanliness of the school-room.

## XVII. LISTLESSNESS.

REMEDIES.

1. By securing proper ventilation.
2. By securing even temperature, — 75°.
3. By avoiding concert recitations.
4. By avoiding the practice of "keeping in" pupils at recess, or after school, for failure in lessons, or behavior.
5. By giving adequate attention to preparatory work.
6. By carefully inspecting the work of each pupil.
7. By exhibiting a real interest in the welfare of the pupil.

## XVIII. PROFANITY.

PREVENTIVES.

1. Teach the children the sinfulness of profane speaking.
2. Train pupils to perfect purity of speech.

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GENERAL POINTS.

1. Provide proper means for the activity of children.
2. Train pupils not to act without weighing motives, feelings, or claims.
3. Do not attempt to instil too many habits at once.

4. Concern yourself with the general welfare of each pupil.
5. Deal openly, justly, and resolutely on all occasions; and reprove openly, when the offence has been open.
6. Distinguish between offences that originate from ignorance, forgetfulness, or sinfulness.
7. Lead pupils to govern themselves.
8. Preventive is better than punishment.
9. The preventive of evil is better than the cure.
10. Reform the offender.
11. Do not make threat of punishment in advance of offences.
12. Let the child learn to be obedient by being obedient.
13. Captivate the right doers, and capture the wrong doers.
14. Cultivate a public opinion in school in favor of right.
15. Strong terms of reproof should be sparingly used, in order to be effective.
16. He best uses punishment who uses it least.
17. Bear in mind that loss of temper, however excusable, is really a victory to wrong doers.
18. Minimum of punishment is the maximum of qualification.
19. Make your punishment light, but certain as the rising sun.
20. Let your government be steady, uniform, and consistent.
21. Manifest a real sympathy for children, and an earnest desire for their happiness and improvement.
22. Secure the love and respect of your pupils, and retain it.
23. Let duty be above all consequences.
24. Require the pupils to have a place for everything. Teacher see that everything is in its place.
25. Pupils should leave the seat only by the permission of the teacher.
26. Pupils should always be held accountable for proper care of property.
27. Pupils should be taught to give quiet and respectful attention when being addressed.

## V.

# ADAMS'S PAPER.

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To give the condition of the Quincy schools before Supt. Parker assumed charge of them, how the subsequent work was done, and what was accomplished under his supervision, the following abstract of a paper by Charles F. Adams, Jr., is inserted.

# THE NEW DEPARTURE IN THE COMMON SCHOOLS OF QUINCY.

THE changes and experiments made in the Quincy schools during the five years of Col. Parker's superintendency caused more than local interest. Mr. Adams was instrumental in producing the reform, and the work justifies a particular statement in regard to the condition of affairs which preceded and led to it. This statement will not be without general value, as that condition of affairs was by no means peculiar to Quincy, and the results reached are attainable anywhere.

### OBJECT OF THE CHANGES.

The object of the changes and experiments was to secure a thoroughly good common-school education at a reasonable cost. The two points of excellence and economy were to be kept clearly in view, and neither was to be subordinated to the other.

### THE SCHOOLS IN A STATE OF IMMOBILITY.

A retrospect of ten years discovered no very remarkable results. The committee found, on examination, that most of the pupils who had finished the grammar course of study could neither speak nor spell their own language correctly, nor read and write it with that elegance which is desirable. The Quincy schools were neither better nor worse than those of surrounding towns.

### HOW THE EXAMINATIONS WERE FORMERLY CONDUCTED.

A day was publicly set aside for each school, and on that day the children were present in their best clothes. The committee sat on the platform in dignified silence, and the teacher conducted the exercises over safe and familiar grounds. The exercises closed with some peculiarly unnatural display of childish declamation. The teacher asked the members of the committee to gratify the children with a few remarks, — which were always of a highly commendatory character. After it was over, the committee knew nothing more about the school than they did before it began; and, as for tests, there were none.

The ever-present object in the teacher's mind was to nave his or her school pass a creditable examination; and, to insure this, the teacher unconsciously turned his scholars into parrots, and made a meaningless farce of education. Certain motions had to be gone through, but for real results there were none. The whole thing was a *sham*. It was, in a word, all *smatter*, *veneering*, and *cram*.

### How the New Committee Conducted the Examinations.

A special branch of studies was assigned to each member of the committee; and, during the examination, the schools were taken wholly out of the hands of the instructors. The results were deplorable. The schools went to pieces. Although the pupils in the grammar schools could parse and construe sentences, and point out the various parts of speech with great facility, repeating correctly and with readiness the rules of grammar applicable in each case, yet, when called upon to write an ordinary letter, they were utterly unable to apply the rules and principles they had so painfully learned, or to form a single sentence, or to follow any rule of composition. So, also, as respects reading. Rote-reading, so to speak, — that is, the practised reading of certain familiar pieces in given Readers, — had been brought to a point of very considerable perfection. Where the severer test of sight-reading, — that is, the reading of an ordinary book which the pupil had never seen before it was put by the examiner into his hands, — where this test was applied, the result was simply bewildering. The greater part of the pupils could merely stammer and bungle along, much as a better-educated person does when reading a book in some language with which he is only imperfectly acquainted. It was found, also, that after eight years' of school-teaching, the children, as a whole, could neither write with facility nor read fluently. The fact was, that the examinations had shown that in far too many cases they could neither read nor write at all. The school system had fallen into a rut. A great multiplicity of studies had in one way and another been introduced, and each was taught by itself.

### Waste of Public Money.

It was plain to the committee that a great waste of public money was steadily going on; but of the amount expended not fifty cents out of each dollar were effectively spent. It was a simple question whether they would leave things as they found them, or attempt a wholly *new departure*. The cost of the schools could not be reduced, but their quality could be improved.

### Members of the Committee Unequal to the Task.

The committee found it useless to attempt any steady improvement through the efforts of individual members. They were busy men and not specialists in education.

Committees elected by popular vote are entirely unequal to any sustained effort; and only through sustained effort can any permanent improvement be infused into teachers, and steady direction given to it. Intelligent direction could only be *attained through a trained superintendent.*

The committee determined to ask the town to employ a superintendent of schools, and to put the working out of the new system into his hands. The authorities of the town granted permission to the committee, and the members began to canvass for *the* man. Now, the first serious difficulty presented itself in the practical selection of an efficient superintendent.

The ordinary superintendent is apt to be a grammar-school teacher, a retired clergyman, or local politician out of a job, who has no more idea of the processes of mental development or the science of training the mind than the average schoolmaster has of the object of teaching grammar.

The committee desired to obtain a trained specialist, knowing that it would be as manifestly absurd to try to elevate the schools without such a man as it would be to try to manage a college without a president.

The committee recognized this fact, that the superintendency had actually fallen into a sort of discredit through the wretched substitutes for trained men to whom towns and cities have in their need been compelled to have recourse. Everything depended on the selection of the right man. The only way to improve the schools was to concentrate the directing individuality in one man, and trust him to infuse his spirit into the others.

### Col. F. W. Parker Selected to do the Work.

After some desultory discussion of candidates, they chanced across one who had not only himself taught, but in teaching had become possessed with the idea that it was a science, and that he did not understand it. Accordingly he had gone abroad in search of that training which he was unable to get in America, and at a comparatively mature age had made himself master of the modern German theories of common school education.

The opportunity was offered to Col. Parker, and under circumstances peculiarly favorable to success.

### The Committee Strong in the Confidence of the People, and Holding Office with a Degree of Permanence.

The committee had gone to work to remedy matters; but, as usually happens in such cases, they had succeeded only in destroying the old system without developing a new one. It gradually, therefore, had begun to dawn upon them that they had taken a larger contract on their hands than they had at all intended. Realizing this,—conscious of the fact that they themselves were unequal to the work before them,—the members of the committee were also sensible enough to know that an agent to be successful must have a chance. He must not be continually hampered and thwarted by unnecessary interference. They were not jealous of their little authority. The superintendent's plans were submitted, and the committee gave them consideration. After the plans were approved, the superintendent had a free field in which to carry them out, with the understanding that by the *results*, and the *results* only, would he be judged. While the members of the committee had ideas of their own, as well as the superintendent, yet in no instance did the superintendent set aside the less clearly defined ideas of the committee. Between the superintendent and the committee there was no conflict.

### The System Marked by Intense Individuality.

The specialty of the superintendent was primary instruction. The result was a gradual revolution in the entire system. The essence of the new system was that there was no system about it; it was marked by *intense individuality*.

### Mechanical Work Ignored.

The programme found no place anywhere in it; on the contrary, the last new theory, so curiously amplified in some of our larger cities, that vast numbers of children should be taught as trains on railroads are run, on a time-table principle,—that they are here now, that they will be at such another point to-morrow, and at their terminus at such a date,—this whole theory was emphatically dismissed. Experiments were to be cautiously tried, and results from time to time noted. The revolution was all pervading. Nothing escaped its influence; it began with the alphabet and extended into the last efforts of the grammar-school course.

### The New Departure Changed the Manner of Teaching.

The change that excited the greatest interest was at the very beginning. The old "dame school" disappeared at once. In place of it appeared something as different as light from darkness. The alphabet was

no longer taught. In place of the old, lymphatic, listless, "school-marm," pressing into the minds of tired and listless children the mystic significance of certain hieroglyphics, instead of this time-honored machine process, young women full of life and nervous energy found themselves surrounded at the blackboard with groups of little children who were learning how to read almost without knowing it; learning how to read, in a word, exactly as they had before learned to talk, not by rule, and rote, and by piecemeal, but altogether and by practice.

The hours of school were kept diversified; the fact was recognized that little children were, after all, little children still, and that long confinement was irksome to them. Blocks and toys were used to amuse and instruct, and occasionally the exercises were stopped that all might join in physical movement.

This system was harder for the teachers, as it called on them to be active and throw themselves into the work. While more exhausting, it was more inspiriting. The children were delighted with the school, and the teachers became conscious of individuality, and took a perceptible pride in the work. She felt in fact that she was doing something in a new way, and doing it uncommonly well.

### The Effect on the Children Pleasing.

The effect produced by the change was, however, the point of interest. Going to school ceased to be a homesick tribulation. The children went to school because they loved to go. The simple fact was, that they were happier, and more amused, and better contented at school than at home.

The drudgery of the impossible primer no longer made infant life miserable. The alphabet was robbed of its terrors, and stole upon them unawares; while the most confounding thing to the members of the committee was, that in hearing the primaries read, not a child among them could repeat its letters, or even know their names, unless, perchance, to the teacher's increased trouble they had been taught at home.

### Experiments Tested by Practical Results.

The method, after four years, ceased to be an experiment, as proven by the experience of parents and teachers, as well as observed in the children. The practical results obtained are self-convincing.

All now join in their testimony that the ways of nature are the easiest ways. The lesson is not a very profound one; and it is strange, indeed, that it took so long to find it out. A child learns to *talk* and *walk* — the two most difficult things it is called on to learn in its whole life — without any instruction, and by simple practice. The practice of learning is

not painful to it or wearisome to others; on the contrary, it is an amusement to both. Why the same process should not have been pursued in other and less difficult branches of education, is not apparent. One thing only is clear: it was not pursued. In place of it an arbitrary system of names and sounds, having no significance in themselves, and of rules and formulas absolutely unintelligible except to the mature intellect, was adopted; and with these, generation after generation of children have been tortured. Only now do we deign, in imparting knowledge, to give any attention to natural processes, which have forever been going on before our eyes and in our families; and yet we profess to think that there is no science in primary education, and that all there is to it can be learned in a few hours.

### The Reforms Instituted.

The new departure started with the Quincy primaries, and it left little in them that had not undergone a change. The reorganization was complete. This, however, was entirely the work of Superintendent Parker; the committee simply gave him a free field to experiment in, and the result fully justified them in so doing. Ascending into the several grades of grammar schools, the case was somewhat different. The committee there had their own views, and those views were little else than an emphatic protest against the whole present tendency of the educational system of Massachusetts, — whether school, academy, or university. If there is one thing which may be considered more characteristic of that system of late years than another, it is its tendency to multiply branches of study.

The school-year has become one long period of diffusion and cram, the object of which is to successfully pass a stated series of examinations. This leads directly to superficialty. Smatter is the order of the day. To enter college, the boy of seventeen must know a little of everything; but it is not necessary for him to know anything well, — not even how to write his own language. From this, the vicious system has gone up through the professional, and down through the high, to the very lowest grade of grammar school. No matter whether it can understand it or not, the child must be taught a little of everything; at any rate enough of it to pass an examination.

Against this whole theory and system the Quincy school committee resolutely set their faces. They did not believe in it; they would have nothing to do with it. Instead of being multiplied, the number of studies should, they insisted, be reduced. It was impossible to teach everything in a grammar-school course, and for the vast majority of children a thorough grounding in the elements of knowledge was all that

could be given. The attempt to give more simply resulted in not giving that.

In proof of this the examination papers for admission to high schools were appealed to. These showed the acquirements of the more proficient scholars; for as a rule it is they who go to the high schools. Judging by these papers the graduates of the grammar schools were very far from proficient in either writing, spelling, or grammar. Now, these are things which the common schools can and should give all children, no matter what else is sacrificed. But they are not given for the simple reason that to give them requires practice, and the multiplicity of studies forbids practice in any one study. The results of the old system in Quincy, as brought to light through the earlier examinations, have already been referred to; the ridiculous knowledge, for instance, of parts of speech and abstract rules of grammar, acquired in order to be able to parse complicated sentences, but combined with an utter inability to correctly write or decently spell the words of the most ordinary letter.

Under these circumstances the general policy outlined by the committee was sufficiently radical.

### Execution Entrusted Wholly to the Superintendent.

Its execution was entrusted wholly to the superintendent. Education was to recur to first principles. Not much was to be attempted; but whatever was attempted was to be thoroughly done, and to be tested by its practical results, and not by its theoretical importance. Above all, the simple comprehensible processes of nature were to be observed. Children were to learn to read and write and cipher as they learned to swim, or skate, or to play ball. The rule by which the thing was done was nothing; the fact that it was done well was everything.

### Books Hustled out of Schools.

English grammar as now taught in our schools is a singularly unprofitable branch of instruction. It was now immediately hustled out of them; and the reader was sent after the grammar, and the spelling-book after the reader, and the copy-book after the speller. Then the process of simplification began. Reading at sight, and writing off-hand were to constitute the basis of the new system. The faculty of doing either the one or the other of these could, however, be acquired only in one way,— by constant practice. Practice took time, and neither school-days nor school-hours were endless. Economy of time, therefore, was above all else necessary; and economy of time was wholly incompatible with multiplicity of studies. Under the old system, everything had been taught

separately. The reading lesson, the writing lesson, the spelling lesson, had, in regular order, followed the lesson in grammar, and in arithmetic, and in geography, and in history. Two afternoon half-hours each week, for instance, would be devoted to the copy-books, a blotted pile of which on the master's desk testified unmistakably to the inadequate results reached. The children then could glibly tell what a peninsular was, but they did not know one when they lived on it; they could stand up and spell in a spelling-bee, but put a pen in their hands, and the havoc they made with orthography was wonderful. Seven studies have been enumerated; all considered elementary. Instead of adding yet others to these the direction of the committee was that they should be reduced to three, — "the three R's," — reading, writing, and arithmetic.

### Subjects to be Taught by Incessant Practice.

The process by which this was to be brought about was simple enough. Reading and writing were to be regarded as elementary; as such they were to be taught in the primary schools. They were to be taught there, also, by incessant practice, book and pencil in hand; and no scholar who could not read at sight, and write with comparative ease, could be considered ready for promotion. Then, in the grammar grades, concentration was reduced to a system. Instruction in reading, writing, grammar, spelling, and, to a very considerable degree, in history, and geography, were combined in two exercises, — reading and writing. The old reader having disappeared, the teacher was at liberty to put in the hands of the class geographies, or histories, or magazine articles, and, having read them first, the scholars might write of them afterwards, to show that they understood them. Their attention was thus secured, and, the pen being continually in the hand, they wrote as readily as they spoke, and spelling came with practice. Under this system, the absurdity of ever having expected any adequate results from the old one became apparent. How even the poor results which had been obtained, were obtained, was matter of surprise. To illustrate this, it is but necessary to revert to some of the other branches of education, and, realizing the method in which they are acquired, to then compare it with the methods adopted in the schools for imparting branches less difficult. Take, for instance, walking and talking again, the examples already referred to. Every child acquires these perfectly; he is wholly at home on his feet, and talks with absolute facility. He acquires them thus perfectly by constant practice. He never, in his life, would have learned to walk firmly, or to talk fluently, if he were shut up in a sitting posture, and, after being elaborately instructed in the principles of equilibrium and articulation, were practised in actual walking and talking for half an hour a day each. Yet this was

exactly what was done under the old system of the Quincy schools, as respects reading and writing. The grammar and the copy-book effectually put a stop to all chance of facility in either; for children are slow to learn, and the time given to the study of formulas is time lost in practice.

### Study Under the New Method Full of Life and Interest.

In arithmetic no great changes or improvement in the methods of instruction, as yet, seem possible. The faculty of dealing rapidly with figures is given to some people, and is withheld from others; that, with sufficient attention and labor, almost any one can acquire a tolerable degree of proficiency with them, is, of course, undeniable; but that it can be acquired, except by a strict regard to formulas patiently learned, is, at least, doubtful. As respects geography, it is by no means so, and in no study has the new departure in the Quincy schools been more marked than in this. The old method, all are familiar with, for there are few indeed, who have ever been into a regulation school, who have not heard child after child glibly chatter out the boundaries, and capitals, and principal towns, and rivers of states and nations, and enumerate the waters you would pass through, and the ports you would make, in a voyage from Boston to Calcutta, or New York to St. Petersburg. What it all amounted to is another matter. It approached terribly near the old rote methods. Go, to-day, into the Quincy schools, and in a few moments two or three young children, standing about an earth-board, and handling a little heap of moistened clay, will shape out for you a continent, with its mountains, rivers, depressions, and coast indentations, designating upon it the principal cities, and giving a general idea of its geographical peculiarities. I do not know whether, so far as utility is concerned, the result obtained under this method is very different from that obtained under the other. Geography is not like reading, writing, or arithmetic. In the practical work of ordinary life, a knowledge of it is an accomplishment, rather than a thing of necessary daily use. But there is this difference between the two methods: the study under the new method becomes full of life and interest; while, under the old, it was as tedious and as much like arithmetic and grammar as it could be made. Such was the theory, and obviously, in that its aim was thoroughness,—which it sought to secure by attempting little,—it was a complete negation of the whole present common-school system, founded on a faith in the infinite capacity of children to know, at an early age, a little of everything.

By its results only could this also be judged, and opinions seem to differ as to what is after all the end and aim of a common-school education. On this point, however, the Quincy committee had early defined their position. In their report of 1873, they had laid down utility as the one and only end which should always be kept in view.

### Studies Should Result in Something of Direct Use.

They had then said, "The studies pursued in our common-school course should be so pursued that they may result in something of direct use in the ordinary lives of New England men and women." This being the object they had in view, the success or failure of their new departure was to be measured by what it actually accomplished in that way, and by nothing else. The faculty of easily writing an ordinary letter on a business topic, correctly spelled and properly expressed, is a valuable faculty to have of every-day utility. A knowledge of the rules of grammar may be useful to critics and scholars, but in the lives of ordinary men and women it can be regarded only as a useless accomplishment. The complete expulsion of the grammar from the schools seemed to take away the breath of the old-time masters. It had been taught from the beginning; it was a tradition; it could not be but in ordinary life there was utility in the study. That the scholars could read at sight, without bungling and stumbling over every unusual word the moment they left the familiar page of their readers, — that they could write a simple letter without being painfully conscious of an unaccustomed labor, — these, though very considerable, were by no means the only or even the most noticeable results of the new departure. In the upper grammar, as well as the lowest primary, there was an entire change of spirit, and going to school was no longer what it had been. This was recognized by the parents quite as much as by the teachers.

### Marked Improvement in Attendance Under the New Method.

Not only was there a marked improvement in attendance, but the attendance was cheerful. The "whining schoolboy" was no longer seen "wending like snail unwillingly to school"; and, remembering what had been, it was certainly most pleasant to go into the rooms and feel the atmosphere of cheerfulness, activity, and interest which pervaded them. Not that the children liked their vacations less, but they had ceased to dislike their school-rooms; and to those who remember as vividly as most persons over thirty do, the wholly unattractive, not to say repulsive, character both of the old-time school teaching and the old-time school discipline, this change is one for which those who enjoy the advantage of it may well be grateful.

The improvement of the schools under the new departure, while freely admitted by teachers, parents, and committee, was made even more clearly apparent by the general interest the experiment excited, and the number of those from all parts who came to see for themselves what was being done. Before 1875, no visitor ever entered the schools of Quincy, except some parent now and then, or an occasional acquaintance of a teacher.

In 1878, the number of those coming to observe the new system, especially teachers and specialists in education, was so great that it threatened seriously to interfere with instruction, and the committee found themselves obliged to take measures towards regulating it.

### Economy is Wealth.

But while the improvement was apparent enough, and did not need to be pointed out, the all-important question remained: At what money-cost was it bought? If it involved a heavy addition to taxes, no matter how great the improvement, it was none the less a failure. The common-school system of Massachusetts was, in the view of the committee, in very great danger of crushing the community it was meant to protect. The average annual cost of educating a child in Quincy had increased fivefold in thirty years; and the experience of Quincy in this respect was not exceptional. It has already been suggested that there is such a thing as taxing a community to death; and it is quite apparent that the recent ratio of increase in taxation for school purposes will, if it goes on, soon afford in the case of Massachusetts a practical illustration of the process.

The effort in Quincy had therefore been to so economize expenditure, by better and more intelligent direction, that the town should get in value received one hundred cents for each dollar spent, instead of fifty, or perhaps only forty, cents as had before been the case. On this economical calculation the whole action of the committee was based. The money question was kept steadily in view, and never for a moment did they allow the superintendent's zeal in his work to hide it. The whole thing was a failure unless at least twice the educational results were obtained for the same money. On this point, the figures of their annual reports told the whole story, and it was a plain and unmistakable story. In 1875, when the new departure was made, the annual cost of educating each child was $19.24; three years later, in 1878, it was $15.68. While the quality of the instruction given had been immeasurably improved, its cost had been reduced one-fifth.

### Money Intelligently Applied.

But, to do this, money must be intelligently applied, and not ignorantly muddled away. Honesty and good intentions are not enough; some science is here necessary. At present, among other things, well-meaning stupidity, greediness of petty authority, and jealousy of superior knowledge, on the part of local school committees, are proving terribly expensive luxuries to our towns.

Studied in the light of the recent experience of Quincy, the statistics of the board of education show clearly enough that, under a moderate

computation, an annual waste of some two millions a year is now regularly going on in Massachusetts, from the lack of a pervading and intelligent direction of expenditures for school purposes.

### Success Due to Three Concurring Circumstances.

In conclusion, whatever degree of success has marked the recent experience of Quincy has been due to three concurring circumstances: the town, by its action, retained a committee in office long enough to enable it to mature and carry out an educational policy, — in fact, to all intents and purposes, it was a commission; that committee had a distinct idea of something necessary to be done, and of a method of doing it; and, finally, the assistance of a competent and intelligent executive officer was secured.

This concurrence of circumstances is one not easy to be brought about, and if it is not brought about, there is no remedy, — the community must pay at least twice what they are worth for its schools. For one only of these three conditions can any further public provision be made; that, however, is the most important of the three. An intelligent direction can be given. Altogether too often it is as if, in cities and towns, mills or factories were kept in operation for public purposes, but the care of them was entrusted to shifting committees chosen by popular vote.

Just those mills and factories are indeed running; but, instead of putting into them hemp or cotton or iron to be worked up, we put in our children. The teaching of a human generation is such a very simple business that any one can direct it! The result is precisely the same as if a like policy were pursued in those industries which pay the taxes which support the schools.

If mills and founderies were run in this way, you would have very poor cloth and iron at a very high cost. So it is as respects the common-school system, — only the human intellect is a much more delicate raw material with which to deal, than cotton, or iron ore. The consequence is that very few persons, whose attention has not been particularly called to the matter, have any idea what a wretched article of public education we in Massachusetts are now getting, in spite of the large sum we pay for it. So far as my observation enables me to judge, the old Commonwealth is in this matter living on its past reputation.

### Education now a Science.

Neither can any improvement in the present state of affairs be hoped for from the school committee as it now exists. In a permanent point of view, indeed, the temporary presence of an active-minded, restless man upon a committee is more apt to work an injury than otherwise. He introduces his changes, and does not carry them out. He rides his hobby

for a year or two, in school and committee-room, and then goes away, leaving his hobby behind him. Teachers and scholars, after he has gone, mount the hobby and go through the motions he has taught them, for a time. But they are no better than any other motions; just as a rut, after all, is a rut, and nothing else. Education is now a science, even common-school education. Only within the last thirty years, however, has it become so. Being a science, it must, like all other sciences, be carried forward by specialists, and not experimented on by amateurs. Indeed, the wise amateur is he who will recognize his own insufficiency and call in the assistance of the specialist. In our larger cities, and most noticeably so in the case of cities the size of Boston, the committee system is, therefore, wholly outgrown. It should long since have given way to the commission. Spasmodic, lumbering, changeable, and incapable of that sustained effort necessary to carry out any enlightened policy, the school-committee, once its work has outgrown it, invariably becomes a mere focus of intrigue. Progress through it cannot be said to be impossible; but it is terribly slow, and even more costly than it is slow. Our people have a democratic, and, perhaps, healthy prejudice against commissions; but they come to them at last.

Though no one yet has uttered the word, it is probably not unsafe to predict that the next interest to be entrusted to them for development will be the common schools of our larger cities.

As yet, however, in Massachusetts, so far as the common-school system is concerned, specialists in education do not, as a class, exist. Individuals there are fully qualified for the work,— men of observant character, who have reflected much on their own experience, and are self-trained; but the science of training and developing the human mind, through a careful study of its laws, is not, as yet, recognized here as a science at all. It is looked upon as a business, or a knack,—something to be acquired by practice, or picked up by observation. Young men are elaborately trained in schools of theology, of law, of medicine, and of science; but teaching itself, is, as yet, looked down upon by educationalists as something too ludicrously simple to call for any special preparation. Any one can understand the development of the human intellect! The normal schools are consequently looked to to supply the want, if, indeed, there is a want.

This, however, is not the mission of the normal schools. Their field of usefulness — and it is a very large field — is on a wholly different plane. They supply teachers, and they have their hands full in doing that.

### No Plan Successful in Incompetent Hands.

The teacher, however, even the successful teacher, does not need to have the enlarging influence of an entire liberal education. The superintendent does need it. From the necessity of the case, also, the profes-

sional teacher of the common school, especially the country common school, must be a person contented with the smaller prizes of life. You cannot have forty professors, or persons qualified to be professors, to teach their A B C's, or "the three R's," to the 1,600 children of a country town. It is possible, however, to have one professor, or, at least, a part of one professor, to direct and infuse, with his spirit, the others. But before he can direct or infuse others with his spirit, this man must himself have a spirit. In other words, he must have acquired the principles of his science in the same way that physicians, and lawyers; and clergymen acquire those of their sciences. Until some public provision exists for this, every attempt at an organized superintendency will only result — as those attempts hitherto have resulted — in a dangerously large percentage of failures, bringing discredit on the system. Yet, what is there which does not fail when entrusted to incompetent hands? Is it a campaign, or a ship, or a business, or a household, or a college? In this matter our institutions of higher education would seem to owe a debt of recognition to the cause of general education, which they have been somewhat slow to recognize. There is a missing link here, and, in what should be an American specialty, we seem to be behind other countries.

### Teachers are Made, not like Poets, Born.

The apparent attitude as yet taken by our universities towards our common schools is either that those who direct and develop the latter, must, like poets, be born, and cannot even be improved, or that any one is equal to so simple a work. Certainly, training their graduates for every other path in life, they make no effort to train them for this. And yet, taking into view the vast field of our common-school system, and its intimate connection with the mass of the people, it would not be easy to conceive any position in which a competent teacher, a man believing in his mission, could exercise a wider and larger influence over the future of this country, than in the chair of pedagogy of the past graduate course of one of our great universities. He would teach the teachers. It is encouraging to find, also, that an appreciation of this fact — of the fact that our institutions of higher learning owe something to the cause of general education — begins to find acceptance. To the University of Michigan belongs, in this case, the honor of the lead, through the recent establishment as part of its course of a chair of the science of Education.

Unquestionably the example will speedily be followed elsewhere, and a spirit of scientific instruction will be generally diffused.

### A Trained Superintendent needed in Order to Give Intelligent Direction to Teachers.

The common schools are the one thing in regard to which there is no division of opinion in America. The people of the country cling to them and lavish appropriations upon them in the firm belief that they are the ark of the national salvation. In Massachusetts one-fifth of the entire amount raised by taxation is expended on them. That under these circumstances they should be no better than they now are is a significant fact, meriting more than a passing notice. They are not what they should be, — indeed, they are very far from it. Any practical experience which throws light on the causes of their deficiency is, therefore, of value; any intelligent experiment made with a view to remedying that deficiency cannot be unworthy of attention; what is true of one is probably not untrue of all; and it is a wide-spread public want, — this pressing need of intelligent direction concentrating the costly and misdirected efforts to a given end, and inspiring them with a consciousness of progress, — this advantage of a trained superintendency, which more than all or anything else has been illustrated in the common-school experience of Quincy.

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